



The Arboretum Village

VILLAGE OF LISLE

"Small Enough To Be Your Neighbor, Large Enough To Serve Your Needs"

1040 Burlington Avenue

Lisle, Illinois 60532-1898

0000010

Carl Doerr, Village Manager (630) 271-4116

E-mail: cdoerr@vil.lisle.il.us

July 27, 2000

EPA Region 5 Records Ctr.



235055

Mr. Daniel J. Biederman
Attorney at Law
Law Offices of Chuhak & Tecson
225 West Washington Street
Suite 1300
Chicago, IL 60606-3418

Re: **Lockformer Ground Water Ordinance Request**

Dear Mr. Biederman:

You were present at the Village Board meeting of July 5, 2000 at which time you made a presentation relative to a ground water ordinance request made by you on behalf of parties associated with Lockformer and its 1711 Ogden Avenue property as well as adjoining properties.

At that meeting, you covered a number of topics, and toward the end of that meeting, the Village Board agreed to place this matter on an agenda for a special Village Board meeting to be held on Monday, August 28, 2000, at 7:30 p.m. The Village Board also agreed that any questions the Board members had should be forwarded to me so that I could put them in a letter and send them out to you for an answer.

Please accept this correspondence as a request to answer the questions that follow:

1. What is the life span of TCE, assuming the natural attenuation proposed with existing soil conditions?
2. Upon the chemical breakdown of TCE, what are the risks to health associated with the remaining and/or resulting chemicals?
3. What impact can a severe drought have on the directional flow of TCE?
4. What impact could severe increases in water flow and rainfall have on the directional flow of TCE?
5. If TCE were to reach St. Joseph's Creek or any current or future creek or waterway running below St. Joseph's Creek, how far could this chemical continue to spread and what impact would the chemical spread have on downstream properties?

6. What short-term and long-term economic and environmental effects will the spill have on the Lockformer site; the vacant parcel immediately west of the Lockformer factory site; as well as the properties located adjacent to or within 500' of the Lockformer spill site?
7. What development restrictions will be required of the properties affected or potentially effected by this spill?
8. What are the possible methods of future exposure to this existing chemical?
9. What are the possible situations that can happen if the models used are inaccurate?
10. Who supplied the TCE, and was it the same supplier during the duration of its use by the Lockformer facility?
11. Approximately how much of the TCE was used each month of each year (please list by month and year)?
12. How much did the TCE chemical used cost on an average during each calendar year that it was used?
13. What was the unit of measure it was purchased in?
14. What were inventory controls relative to the use of TCE?
15. Where there any loss or shrinkage per year of the TCE?
16. Were there special procedures for the use of TCE?
17. Were material safety data sheets present, and if so, could you make a copy available and could you forward a copy of the special procedures, if any, that were in place?
18. Was there written regulations or procedures relative to any special handling of the residue and contaminated materials such as gloves, rags, etc.
19. How was the TCE disposed and how much did Lockformer pay for the disposal each month?
20. Was Lockformer charged by the gallon, pound, etc., and was the quantity charged for disposal ever reconciled to the quantity purchased?
21. In what year did Lockformer file suit against the supplier?
22. In what year was the case settled?
23. Did the suit allege that the supplier or the person picking up the TCE spill the TCE or spill a chemical with more descriptive terminology?
24. How many monitoring wells have been drilled and in what years were the wells drilled?
25. In what year were the adjacent homeowners notified of the spill and in what year were their wells tested (list each name and address of the homeowner with the answer given for each one of the properties)?
26. Does Lockformer test its own well on the Lockformer site that is used for Lockformer's potable and non-potable water needs, and if so, were any contaminants noted, and if so, please forward any analyses done from the time the wells were first tested and from the time the contaminant was first noted?
27. Did Lockformer ever sell or attempt to sell land adjacent to its current facility, and if so, to whom and when?
28. Has the I.E.P.A. ever let TCE sit as is suggested at this point? If so, where and when was that allowed?


29. What will TCE degrade into and how long will it take for it to be fully degraded?
30. Has a cost estimate or range been developed to clean up the TCE at the site? If so, who prepared the estimate; what is the estimate; and what did Lockformer consider with respect to that alternative?
31. Why wasn't 511 Chicago contacted?
32. Will Lockformer cover the loss of property values to the owners of property as well as any claims property owners may have as a result of the knowledge of the TCE spill?
33. What procedures will be put in place to allow those suffering damages to recover those damages from Lockformer or successor corporations?
34. What alternatives other than the ground water ordinance are being considered by Lockformer, and what will Lockformer's approach be if the Village does not approve the ground water ordinance?

I have attached a copy of the pertinent portions of the meeting minutes of July 5, 2000, and I ask that you respond to the questions raised therein as well as those mentioned above. If other questions arise, they will be forwarded to you for immediate response.

Please forward your response to the questions in written form to me by no later than Friday, August 18, 2000.

By copy of this correspondence, I am forwarding the questions to Dennis Walsh, the Village's special counsel; to Carlson Environmental; as well as Deuchler Environmental; however, we are looking to you and your experts to answer the questions submitted. The questions are in no particular order; however, they should be answered as they appear by the numbers that precede each question.

Very truly yours,



Carl Doerr
Village Manager

CD:kao

cc: Mayor and Board of Trustees, Village of Lisle
Tim Seeden, Village Clerk
Judy Lagro, Business Office Manager
Barb Adamec, Asst. Village Manager
Tony Budzikowski, Community Development Director
Ray Peterson, Public Works Director
Dennis Walsh, Village of Lisle Special Counsel
Lisa Meagher, Carlson Environmental, 66 East Wacker Pl., Suite 1500, Chicago, IL 60601
Chris Curtin, Deuchler Environmental
~~Lockformer Spill File~~



The Arboretum Village

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1040 Burlington Avenue

Lisle, Illinois 60532-1898

Carl Doerr, Village Manager (630) 271-4116

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August 2, 2000

Mr. Daniel J. Biederman
Attorney at Law
Law Offices of Chuhak & Tecson
225 West Washington Street
Suite 1300
Chicago, IL 60606-3418

Re: Lockformer Ground Water Ordinance: Questions to be Answered

Dear Mr. Biederman:

I will continue to forward questions to you as they arise. Your previous presentation talked about the impact or lack of same the spill had on humans, but the comments have never been directed toward what impact the toxic spill may have on wildlife and/or plant materials.

Please provide an answer to this concern and be prepared to discuss this on August 28, 2000 as well as the other questions which were earlier forwarded to you.

Very truly yours,

Carl Doerr
Village Manager

CD:kao

cc: ~~Lockformer Ground Water Ordinance~~
Mayor and Board of Trustees
Tim Seeden, Village Clerk
Judy Lagro, Business Office Manager
Dennis Walsh, Village of Lisle Special Counsel
Chris Curtin, Deuchler Environmental, Inc.,
Lisa Meagher, Carlson Environmental

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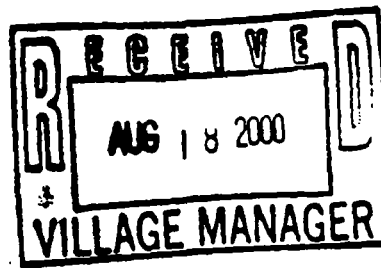
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August 17, 2000

VIA FEDERAL EXPRESS

Mr. Carl Doerr
Village Manager
Village of Lisle
1040 Burlington Ave.
Lisle, IL 60532-1898



Re: Lockformer Ground Water Ordinance Request

This correspondence shall respond to your letters dated July 27, 2000 and August 2, 2000. The answers contained herein were prepared in a collaborative effort by representatives of The Lockformer Company, Carlson Environmental, the environmental consulting firm of Huff & Huff, Inc., and Chuhak & Tecson, P.C. It is Lockformer's sincere desire that the answers contained herein reflect its commitment to the Lisle community and its belief that its experts have selected the appropriate course of action to resolve this matter.

1. What is the life span of TCE, assuming the natural attenuation proposed with existing soil conditions?

ANSWER: The half life of TCE in the environment is 4.52 years. Therefore, the concentrations of TCE at the Lockformer site are expected to be reduced in half in 4.52 years. In general, the half life of a chemical due to degradation is $dC / dt = -kC$ where: C is the concentration of the chemical in milligrams per liter (mg/l) or parts per million (ppm); t=time in days; k=degradation constant. Integrating the differential equation - $\int dC/C = -k \int dt$ over concentration C_0 to C_1 and time t_0 to t_1 then $\ln C = \ln C_0 - kt$

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$$C_0 \quad t_0$$

At initial time t_0 ; $\ln C = -kt + \ln C_0$; $\ln C/C_0 = \exp(-kt)$; $\ln C/C_0 = -kt$; half life $C = C_0/2$; $\ln 1/2 = -kt$ or time for half life $(t) = 0.6931 / k$.

The first order degradation constant (k) for TCE = 0.00042 / day; so the half life $t = 0.6931 / 0.00042 = 1650$ days or 4.52 years.

2. Upon the chemical breakdown of TCE, what are the risks to health associated with the remaining and/or resulting chemicals?

ANSWER: TCE under anaerobic conditions will form a less toxic compound, cis-1,2-dichloroethylene (c-DCE), a more reduced compound. Anaerobic conditions typically exist at the location of spills; however, as the plume travels, aerobic conditions exist. If anaerobic conditions persist, c-DCE, can theoretically form vinyl chloride; however the rate of formation is significantly slower than the rate TCE is degraded to a c-DCE. Under aerobic conditions, vinyl chloride is readily oxidized, forming carbon dioxide, water, and chloride ions. C-DCE is also readily oxidized, although the rate is slower than the oxidation of vinyl chloride. TCE, because of its highly oxidized state, is only slowly aerobically oxidized.

At this site, vinyl chloride has only been found at low concentrations within the source area. The absence of vinyl chloride outside the source is attributed to the aerobic conditions, when the c-DCE (and any vinyl chloride) is being degraded to carbon dioxide, water and chloride ions, as it extends from the source area.

Exhibit A provides chemical fact sheets and Material Safety Data Sheets for TCE, cis-1,2-dichloroethene and vinyl chloride which provide chemical specific information including use,

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physical and chemical properties, sensitivity, environmental impact, environmental fate, drinking water impact data, fate and transport, exposure pathways, metabolism and health effects.

3. What impact can a severe drought have on the directional flow of TCE?

ANSWER: In general, ground water moves in all directions from uplands towards streams and towards well fields. In areas unaffected by heavy pumping, the piezometric surface conforms generally to the configuration of the land surface. A piezometric surface is an imaginary surface to which water will rise in artesian wells. Water levels in glacial drift wells typically show a pattern of seasonal fluctuation (i.e., ground water levels lower in times of drought and higher in time of high precipitation). Aside from a catastrophic event which would change the general topography of the land surface, the general direction of ground water flow from uplands to streams should not change drastically.

4. What impact could severe increases in water flow and rainfall have on the directional flow of TCE?

ANSWER: Please refer to question number 3.

5. If TCE were to reach St. Joseph's Creek or any current for future creek or waterway running below St. Joseph's Creek, how far could this chemical continue to spread and what impact would the chemical spread have on downstream properties?

ANSWER: The models developed/accepted by the Illinois Environmental Protection Agency ("IEPA") indicate that TCE will not reach St. Joseph's Creek, being fully degraded before reaching the Creek. The experience of Lockformer's experts has been that the models developed/accepted by the IEPA over-predict travel distances for plumes of chemical concentrations. In addition, water

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quality objectives in streams for TCE are considerably higher than the drinking water standards. For example, Ohio has set the TCE standard for aquatic habitat at a maximum value of 1.7mg/L, with a 30-day average of 0.075 mg/L. In addition, hydrolysis volatility, and degradation of TCE in streams results in rapid losses within very short distances of entering streams. For example in groundwater, TCE has a reported degradation rate of 0.00042/day versus 360/day in streams, or nearly a million times faster (See Superfund Chemical Data Matrix for TCE compared to TACO degradation rate provided as Exhibit B).

In summary, St. Joseph creek will not be impacted by the TCE residual at Lockformer.

6. **What short-term and long-term economic and environmental effects will the spill have on the Lockformer site; the vacant parcel immediately west of the Lockformer factory site; as well as the properties located adjacent to or within 500' of the Lockformer spill site?**

ANSWER: Lockformer's goal is to secure a No Further Remediation ("NFR") letter from the IEPA, based upon a required showing that the risk is less than 1 in a million of developing cancer. Currently in the U.S., a third of the entire population, or 333,333 people out of every million people will develop cancer. The State of Illinois has determined an acceptable risk is an increment of the one in a million, thus changing the risk from 333,333 per million to 333,334 per million.

Once the NFR Letter is issued, the economic value of Lockformer's property will increase significantly. Lockformer's expert's experience is that the market will actually pay a premium for property having a NFR Letter because uncertainty concerning the environmental issues has been eliminated.

7. **What development restrictions will be required of the properties affected or**

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potentially effected by this spill?

ANSWER: The Lockformer property (711 Ogden Avenue) will be required to remain industrial/commercial and the ground water ordinance will prohibit any new potable wells from being installed on the property. The properties to the south of the Lockformer facility will be included in the ground water ordinance and will be prohibited from installing any new potable wells. No other restrictions to other properties will be required.

8. What are the possible methods of future exposure to this existing chemical?

ANSWER: Methods of exposure include the following:

- Soil Inhalation
- Soil Ingestion
- Ground Water Ingestion
- Dermal Contact

Soil inhalation, ingestion and dermal contact exposure routes are eliminated by the placement of an engineered barrier above the spill/source area. The barrier must be properly maintained and is transferrable with the property under an institutional control. If intrusive work is to be conducted beneath the engineered barrier (i.e., if the barrier is breached), proper procedures must be followed to ensure appropriate health and safety issues for construction workers.

To exclude the ground water ingestion exposure route, the potable drinking water wells located south of the Lockformer facility must be taken out of service and the residents must be connected to the public water supply. Thus, the ground water in the area of the spill will not be

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consumed as drinking water. In addition, models developed/accepted by the IEPA show that the contamination will not migrate to a location where the ground water will be consumed.

If the ground water ordinance is adopted, it will ensure that future potable wells cannot be installed in the area and exposure to potential contaminants via ground water ingestion will not take place.

The inhalation, ingestion and dermal contact of soil is not an issue down gradient of the spill site because the impacted soil has not migrated south of the Lockformer facility boundary and the depth to ground water which is impacted off site is 45 and 50 feet below grade.

9. What are the possible situations that can happen if the models used are inaccurate?

ANSWER: The models developed/accepted by the IEPA that were used to predict the future migration and concentration of contaminants are very conservative. Default values for the physical and chemical parameters which are used in the modeling equations are chemical specific and take into consideration site-specific data. Most importantly, in addition to the modeling, empirical data collected from groundwater wells confirms that the models are accurate. Furthermore, in addition, to the modeling, 29 monitoring wells have been installed to verify the results. These monitoring well results have verified that the modeling is conservative, over-predicting the actual levels.

10. Who supplied the TCE, and was it the same supplier during the duration of its use by the Lockformer facility?

ANSWER: The current Lockformer facility was constructed at 711 Ogden Avenue in 1968. Upon completion of the building in 1968 Baran Blakeslee supplied Lockformer a roof top storage

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tank for the storage of product TCE and began supplying the TCE needed in the manufacturing process. Subsequent to 1968, Baran Blakeslee was acquired by Allied Signal, Inc. who continued to supply TCE. Once Lockformer management discovered that TCE had been spilled onto the ground by Baron Blakesley/Allied Signal, Lockformer promptly notified Allied Signal and requested that Allied Signal immediately revise/correct its delivery procedures and conduct all necessary investigation/remediation. After discussions with Allied Signal proved fruitless, a lawsuit was filed and Allied Signal stopped supplying TCE. Subsequent to Allied Signal, Lockformer has purchased degreasing solvent from Finishing Equipment and Coleman Chemical.

11. Approximately how much of the TCE was used each month of each year (please list by month and year)?

ANSWER: Records maintained by Lockformer do not provide a detailed accounting of TCE usage per month since operations began in 1968. Historical TCE usage has depended upon many factors including manufacturing output and the type of degreasing equipment used. In the past thirty two years, Lockformer has upgraded its vapor degreaser equipment utilizing efficient equipment that minimizes the amount of degreasing solvent required. Available records indicate that TCE usage varied from \$135 to \$291 per week.

12. How much did the TCE chemical used cost on average during each calendar year that it was used?

ANSWER: As previously stated, historical records are incomplete. Currently, solvent cost is \$.67 per pound (12.25 pounds per gallon). Therefore, a gallon of solvent costs Lockformer \$8.21. A 55-gallon drum costs Lockformer approximately \$451.55.

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13. What was the unit of measure it was purchased in?

ANSWER: Solvent is priced per pound and delivered in a 55-gallon sealed drum.

14. What were inventory controls relative to the use of TCE?

ANSWER: TCE is considered a non-inventory item similar to paint. Mass balance (reconciling product with spent solvent, i.e. waste solvent) is not an appropriate inventory control due to fugitive emission (i.e. evaporation) loss of the product.

15. Was there any loss or shrinkage per year of the TCE?

ANSWER: As stated above, loss of this product in the form of fugitive emissions is common.

16. Were there special procedures for the use of TCE?

ANSWER: Yes. The storage, use and disposal of TCE at Lockformer have always had specific handling guidelines. Lockformer's handling guidelines included the guidelines outlined in the MSDS sheets (Exhibit C includes a copy of PPG MSDS sheets that offer guidelines which Lockformer followed as far as product handling). Due to the cost of the material, Lockformer has always adhered to prudent and careful handling practices. Most importantly, upon implementation of the Federal Resource Conservation and Recovery Act, Lockformer has adhered to the handling, record keeping and disposal requirements of this Act.

17. Were material safety data sheets present, and if so, could you make a copy available and could you forward a copy of the special procedures, if any, that were in place?

ANSWER: Lockformer has always fully complied with the requirements of the Federal Emergency Planning and Community Right to Know Act as well as OSHA. MSDS sheets have

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always been present for employees to review. Special written procedures implemented at Lockformer are attached as Exhibit D.

- 18. Were there written regulations or procedures relative to any special handling of the residue and contaminated materials such as gloves, rags, etc.?**

ANSWER: See previous answer.

- 19. How was TCE disposed and how much did Lockformer pay for the disposal each month?**

ANSWER: Hydrite Chemical Co. is Lockformer's certified waste hauler. Generally, there is not monthly removal. They are called on an "as-needed" basis and handle all manifests. From invoice copies, the cost to dispose of a 55-gallon drum is \$110.00 based on the invoices available, there were nine "pick-ups" since August of 1988 (frequency - once every three months).

- 20. Was Lockformer charged by the gallon, pound, etc., and was the quantity charged for disposal ever reconciled to the quantity purchased?**

ANSWER: See answer to number 12 for price of product per gallon. Amounts of disposal vs. quantities purchased are not reconciled.

- 21. In what year did Lockformer file suit against the supplier?**

ANSWER: The lawsuit was filed on March 31, 1993.

- 22. In what year was the case settled?**

ANSWER: December, 1994.

- 23. Did the suit allege that the supplier or the person picking up the TCE spill the TCE or spill a chemical with more descriptive terminology?**

ANSWER: The only substance at issue in the referenced lawsuit was trichloroethylene

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(TCE).

- 24. How many monitoring wells have been drilled and in what years were the wells drilled?**

ANSWER: A total of twenty-nine (29) monitoring wells have been installed as follows:

Six (6) monitoring wells installed in April and May of 1995.

Three (3) monitoring wells installed June and July 1997.

Nine (9) monitoring wells installed August 1998.

Nine (9) monitoring wells installed February 1999.

Two (2) monitoring wells installed December 1999.

- 25. In what year were the adjacent homeowners notified of the spill and in what year were their wells tested (list each name and address of the homeowner with the answer given for each one of the properties)?**

ANSWER: Four adjacent residents' wells were sampled in July of 1999. The resident addresses are 634 Ogden Avenue (resident and tenant), 515 Chicago Avenue, and 4708 Elm Street. A meeting was held on March 9, 2000 with various residents (515 Chicago Avenue, 4703 Elm Street and 4708 Elm Street) at the Lockformer facility. This meeting was conducted to answer any questions that the residents may have had concerning the status of the spill as well as to request that the homeowners allow Lockformer to connect their homes to the public water supply. In addition, the owner of 511 Chicago Ave. has been contacted by Lockformer and Lockformer has answered all questions posed by this owner. Furthermore, Lockformer has sent correspondence to the owner of the property located 4712 Elm Street.

- 26. Does Lockformer test its own well on the Lockformer site that is used for**

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Lockformer's potable and non-potable water needs, and if so, were any contaminants noted, and if so, please forward any analyses done from the time the wells were first tested and from the time the contaminant was first noted?

ANSWER: Although the well located at the Lockformer facility is a potable water well, it is currently not used by employees at Lockformer for drinking water purposes. However, the well was tested by STS Consultants on April 22, 1992. The results of this testing did not reveal any contaminants of concern above drinking water standards. Exhibit E includes a copy of the sampling results.

27. Did Lockformer ever sell or attempt to sell land adjacent to its current facility, and if so, to whom and when?

ANSWER: Lockformer's marketing efforts of the adjacent land are considered confidential. Lockformer's environmental consultants have expressed an opinion that the adjacent property qualifies for an unencumbered No Further Remediation Letter from the IEPA. Further, the presence of TCE on the Lockformer site does not present a threat to the adjacent property owned by Lockformer. Therefore, the presence of TCE on the Lockformer facility site is not expected to impair the value of the adjacent property.

28. Has the I.E.P.A. ever let TCE sit as is suggested at this point? If so, where and when was that allowed?

ANSWER: Currently, the IEPA's Tiered Approach to Corrective Action Objectives (TACO), follows the concept of risk-based clean-up objectives. The IEPA allows any contaminant of concern, including TCE, to remain in ground water as long as no potential exposure (i.e., risk) to a potential receptor is available. Various communities have developed city-wide ground water

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ordinances in Illinois in order to eliminate future exposure or risk by the ingestion of ground water that contains contaminants of concern.

In summary, through the end of 1999, the IEPA Site Remediation Program had enrolled 1,214 contaminated sites, voluntarily. According to the "1999 Annual Report" (provided as Exhibit F) issued by the SRP Program:

"Close to half of the NFR Letters issued have institutional controls in place. Approximately 26% of these institutional controls rely on a ground water ordinance that limits the community's drinking water source to a public water supply" (pg 8).

Through the end of 1999, twenty eight (28) communities had adopted ground water ordinances that were approved by the IEPA for use as an institutional control.

29. What will TCE degrade into and how long will it take for it to be fully degraded?

ANSWER: At the Lockformer site the TCE is being reduced to cis-1,2-dichloroethylene, under anaerobic conditions. The c-DCE is then being degraded aerobically to carbon dioxide, water, and chloride ions. See response to question number 2.

30. Has a cost estimate or range been developed to clean up the TCE at the site? If so, who prepared the estimate; what is the estimate; and what did Lockformer consider with respect to that alternative?

ANSWER: Several remediation strategies have been investigated for the TCE presence at the Lockformer site. However, proven, safe and cost-effective technologies to remediate TCE source contamination in most ground water environments are currently not available. Conventional ground water remediation technologies in place at TCE sites (ground water extraction and treatment) remove

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Mr. Carl Doerr

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material that has dissolved in the ground water. These technologies employ long-term, active processes that are often costly and quickly reach a point of diminishing returns. In addition, small amounts of TCE mass can recontaminate ground water generally making remediation to current regulatory criteria impracticable (Source: Natural Attenuation of Chlorinated Solvents in Ground Water: Principles and Practices, Version 3.0, August 1997, RTDF).

Remediation/management strategies for most chlorinated solvent (TCE) sites focuses on integrating innovative, cost-effective techniques that will operate over the long term to mitigate risk to human health and the environment through containment. Natural attenuation is ideally suited for integration into long-term site management to address chlorinated solvents dissolved in ground water. (Source: Natural Attenuation of Chlorinated Solvents in Ground Water: Principles and Practices, Version 3.0, August 1997, RTDF).

Based on the natural attenuation remedial process that is being proposed, physical, chemical, and/or biological processes will act to reduce the mass, toxicity and/or mobility of subsurface contaminants in a way that reduces risk to human health and the environment to acceptable levels. To eliminate risk to human health and the environment to potential contaminants, the exposure pathway must can be eliminated (i.e., the use of ground water, in this case, can be removed). The ground water ordinance will prohibit the future installation of drinking water wells in the specified area and in turn, eliminate the exposure to future contaminants in the ground water.

31. Why wasn't 511 Chicago contacted?

ANSWER: 511 Chicago was contacted by Lockformer through written correspondence dated

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February 4, 2000. Prior to the July 5, 2000 Village Board Meeting, Lockformer attempted to contact the owner via telephone on numerous occasions. The owner of this Property has been involved in ongoing discussions with Lockformer since July 5, 2000 regarding the status of the spill and the possible hook up of that residence to the Village water supply.

- 32. Will Lockformer cover the loss of property values to the owners of property as well as any claims property Owens may have as a result of the knowledge of the TCE spill?**

ANSWER: As discussed above, Lockformer believes the best way to remove uncertainty and preserve property values within the community is to implement its current strategy of obtaining an NFR Letter from the IEPA. An NFR Letter, issued by the state agency vested with the public responsibility to protect the environment, demonstrates that no risk to human health or the environment exists. At the present time, Lockformer has no credible way of quantifying "loss of property values." Lockformer remains committed to its neighbors to consider any reasonable request for such damage and will evaluate each request on a case by case basis.

- 33. What procedures will be put in place to allow those suffering damages to recover those damages from Lockformer or successor corporations?**

ANSWER: Please see answer to questions number 32.

- 34. What alternatives other than the ground water ordinance are being considered by Lockformer, and what will Lockformer's approach be if the Village does not approve the ground water ordinance?**

ANSWER: Lockformer will continue to request its environmental experts monitor the advancements in remedial technology and is committed to implementing safe, effective methods for reducing risk to either human health or the environment.

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35. (Supplemental question posed in the August 2, 2000 letter)
What impact may the toxic spill may have on wildlife and/or plant materials?

ANSWER: The in-place engineered barrier located on the site eliminates exposure to animals and plants of any TCE residuals remaining in the soil.

Lockformer has answered the foregoing questions to the best of its ability based on information currently available. Lockformer is willing to discuss any of the answers contained herein in further detail upon request. Lockformer continues to welcome further questions by the Village of Lisle or its citizens.

Sincerely,

A handwritten signature in black ink that reads "Daniel J. Biederman" followed by a circled set of initials "JAD".

Daniel J. Biederman

cc: Dennis Walsh, Village of Lisle Special Counsel, via federal express
Rian Scheel
Jim Heitt

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
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EXHIBIT A



No. 312
TRICHLOROETHYLENE
(Revision E)

Issued: July 1979
Revised: August 1987

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: TRICHLOROETHYLENE

DESCRIPTION (Origin/Uses): Prepared from sym-tetrachloroethane by way of eliminating HCl by boiling with lime. Used to manufacture organic chemicals, pharmaceuticals; in degreasing and dry cleaning; and as a solvent for fats, waxes, rubbers, oils, paints, varnishes, ethers, and cellulose esters.

OTHER DESIGNATIONS: Ethylene Trichloride; TCE; Trichloroethene; 1,1,2-Trichloroethylene;

C₂HCl₃; NIOSH RTECS #KX4550000; CAS #0079-01-6

MANUFACTURER/SUPPLIER: Available from several suppliers, including:

Dow Chemical USA, 2020 Dow Center, Midland, MI 48640;

Telephone: (517) 636-1000; (800) 258-CHEM

COMMENTS: Trichloroethylene is a toxic solvent and a suspected occupational carcinogen.

HMIS

H 2

F 1

R 1

PPE*

R 1

I 3

S 1

K 0

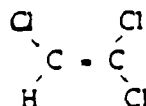
* See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS

Trichloroethylene, CAS #0079-01-6; NIOSH RTECS #KX4550000

%

HAZARD DATA



- The TLV-TWA is set to control subjective complaints such as headache, fatigue, and irritability.
- The TLV-STEL is set to prevent incoordination and other beginning anesthetic effects from TCE. These levels should provide a wide margin of safety in preventing liver injury.
- *** The OSHA PEL is 300 ppm for 5 minutes in any 2 hours.

ACGIH Values 1987-88

TLV-TWA*: 50 ppm, 270 mg/m³

TLV-STEL*: 200 ppm, 1080 mg/m³

OSHA PEL 1986***

8-Hr TWA: 100 ppm

Ceiling: 200 ppm

NIOSH REL 1986

10-Hr TWA: 25 ppm

TOXICITY DATA

Human, Oral, LD₅₀: 7 g/kg

Human, Inhalation, TC_{Lo}: 6900 mg/m³

(10 Min)

Human, Inhalation, TC_{Lo}: 160 ppm

83 Min

Human, Inhalation, TD_{Lo}: 812 mg/kg

SECTION 3. PHYSICAL DATA

Boiling Point ... 188.6°F (87°C)

Vapor Pressure ... 58 Torr at 68°F (20°C)

Water Solubility ... Insoluble

Vapor Density (Air = 1) ... 4.53

Evaporation Rate ... Not Listed

Specific Gravity ... 1.4649 at 68°F (20°C)

Melting Point ... -120.64°F (-84.8°C)

Molecular Weight ... 131.40 Grams/Mole

Appearance and odor: Colorless, nonflammable mobile liquid; sweetish odor like chloroform.

COMMENTS: TCE is highly soluble in lipids. A high vapor pressure at room temperature provides the potential for TCE vapors to contaminate use areas.

SECTION 4. FIRE AND EXPLOSION DATA

LOWER

UPPER

Flash Point and Method

Autoignition Temperature

Flammability Limits in Air

Not Listed

770°F (410°C)

% by Volume

8%

10.5%

EXTINGUISHING MEDIA: TCE has no flash point in a conventional closed tester at room temperature, but it is moderately flammable at higher temperatures. Use dry chemical, carbon dioxide, alcohol foam, or other extinguishing agents suitable for the surrounding fire.

OSHA Flammability Class (29 CFR 1910.106): Not Regulated

UNUSUAL FIRE/EXPLOSION HAZARDS: During fire conditions TCE emits highly toxic and irritating fumes, including hydrochloric acid and phosgene. **SPECIAL FIRE-FIGHTING PROCEDURES:** Wear a self-contained breathing apparatus with a full facepiece operated in a pressure-demand or another positive-pressure mode. At TCE vapor levels of 300-1000 ppm, fire fighters who lack the proper respiratory equipment may experience incoordination and impaired judgment.

DOT Flammability Class (49 CFR 173.115): Not Regulated

SECTION 5. REACTIVITY DATA

Trichloroethylene is stable. Hazardous polymerization can occur under certain circumstances (see Conditions to Avoid and Comments, below).

CHEMICAL INCOMPATIBILITIES include magnesium or aluminum powder, NaOH, KOH, or other strong alkaline materials. Reactions with alkaline materials may lead to the formation of dangerous explosive mixtures of chloroacetylenes.

CONDITIONS TO AVOID: When TCE is heated (as in the case with vapor degreasers) or exposed to sunlight, it requires extra stabilization against oxidation, degradation, and polymerization. It is slowly decomposed by light when moist.

PRODUCTS OF HAZARDOUS DECOMPOSITION include hydrochloric acid and phosgene under certain conditions at elevated temperatures.

COMMENTS: TCE is stable under normal handling and storage conditions, and hazardous polymerization is not expected to occur. However, failure of the stabilizer at elevated temperatures or other extreme conditions may allow polymerization to take place.

SECTION 6. HEALTH HAZARD INFORMATION

Trichloroethylene is listed as a carcinogen by the NTP, IARC, and OSHA. NIOSH recommends that trichloroethylene be treated as an occupational carcinogen. IARC carcinogenic results are animal suspect, animal positive, and human indefinite. **SUMMARY OF RISKS:** Moderate exposures to TCE cause symptoms similar to those of alcohol intoxication. Higher concentrations cause narcotic effects. Ventricular fibrillation has been cited as the cause of death following heavy exposures. TCE-induced hepato cellular carcinomas have been detected in mice during tests conducted by the National Cancer Institute (Chem & Eng News 54 (April 5, 1976):4). Organ systems affected by overexposure to TCE are the central nervous system (anesthesia, ataxia, apnea), degeneration of the liver and kidneys, the lungs (edema), heart (arrhythmias) and skin (irritation, vesication, and paralysis of fingers when immersed in liquid TCE). Contact with the liquid defats the skin, causing topical dermatitis. Certain people appear to experience synergistic effects from TCE exposure concomitant with exposure to caffeine, alcohol, and other drugs. When combined with alcohol intake, toxic effects are increased and may cause a red, blotchy facial and upper body rash commonly called "degreaser's flush." Other reported symptoms of TCE exposure include abnormal fatigue, headache, irritability, gastric disturbances, and intolerance to alcohol. Toxic effects from testing of TCE on humans include hallucination, distorted perception, somnolence (general depressed activity), and jaundice. **TARGET ORGANS:** Respiratory system, central nervous system, heart, liver, kidneys, and skin. **PRIMARY ENTRY:** ingestion, inhalation, skin contact. **ACUTE EFFECTS:** Headache, vertigo, visual disturbance, tremors, nausea, vomiting, dermatitis, dizziness, drowsiness, and irritation to the eyes, nose, and throat. **CHRONIC EFFECTS:** None Reported. **MEDICAL CONDITIONS AGGRAVATED BY LONG-TERM EXPOSURE:** Diseases of the liver, kidneys, lungs, and central nervous system. **FIRST AID: EYE CONTACT** Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. Get medical help. **SKIN CONTACT:** Wash thoroughly with soap and water. Remove and launder contaminated clothing before wearing it again; clean material from shoes and equipment. Get medical help. **INHALATION:** Remove victim to fresh air; restore and/or support his breathing as needed. Do not give artificial respiration to the victim. Get medical help. **INGESTION:** Call a poison control center. Never give anything by mouth to someone who is unconscious or convulsing. A professional decision regarding whether or not to induce vomiting is required. Do not give artificial respiration to the victim. Get medical help. **GET MEDICAL ASSISTANCE - IN PLANT, PARAMEDIC, COMMUNITY:** Get prompt medical assistance for further treatment, observation, and support after first aid.

COMMENTS: Workers' responses to TCE vary significantly because of many factors, including age, health status, nutrition, and intake of alcohol, caffeine, and medications. Do not use these substances before, during, or after exposure to TCE. If a worker displays any of the symptoms of exposure to TCE, thoroughly investigate all the possible contributing factors to determine, if possible, how much the work environment levels of TCE are responsible.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL/LEAK: Inform safety personnel of any trichloroethylene spill or leak and evacuate the area for large spills. Cleanup personnel must use respiratory and liquid contact protection. Adequate ventilation must be provided. Confine the spilled TCE to as small an area as possible. Do not allow it to run off to sewers or open waterways. Pick up spilled TCE with a vacuum cleaner or an absorbent such as vermiculite.

DISPOSAL: Consider reclamation, recycling, or destruction rather than disposal in a landfill.

Trichloroethylene is designated as a hazardous substance by the EPA (40 CFR 116.4).

Trichloroethylene is reported in the 1983 EPA TSCA Inventory.

EPA Hazardous Waste Number (40 CFR 261.33): U228

EPA Reportable Quantity (40 CFR 117.3): 1000 lbs (454 kgs)

Aquatic Toxicity Rating, TLM 96: Not Listed

SECTION 8. SPECIAL PROTECTION INFORMATION

GOGGLES: Always wear protective eyeglasses or chemical safety goggles. Follow the eye and face protection guidelines of 29 CFR 1910.133. **GLOVES:** Wear impervious gloves. **RESPIRATOR:** Use a NIOSH-approved respirator per the NIOSH Guide to Chemical Hazards (Genium ref. 88) for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. Any detectable concentration of TCE requires an SCBA, full facepiece, and pressure-demand/positive-pressure modes. **WARNING:** Air-purifying respirators will not protect workers from oxygen-deficient atmospheres. **OTHER EQUIPMENT:** Wear rubber boots, aprons, and other suitable body protection appropriate to the existing work environment. **VENTILATION:** Install and operate general and local exhaust ventilation systems of sufficient power to maintain airborne concentrations of TCE below the OSHA PEL standards cited in section 2. **SAFETY STATIONS:** Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. **OTHER SPECIAL MODIFICATIONS IN THE WORKPLACE:** Because of the unresolved controversy about the carcinogenic status of TCE, all existing personal protective equipment and engineering technology should be used to prevent any possibility of worker contact with this material.

COMMENTS: Practice good personal hygiene. Keep material off of your clothes and equipment. Avoid transfer of material from hands to mouth while eating, drinking, or smoking. Adhere to the sanitation requirements of 29 CFR 1910.141 and 29 CFR 1910.142.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

STORAGE SEGREGATION: Prevent TCE from coming into contact with strong caustics such as NaOH, KOH; chemically active metal like Ba, Li, Na, Mg, Ti; and powdered aluminum or magnesium in acidic solutions. **SPECIAL HANDLING/STORAGE:** Store this material in a cool, dry, well-ventilated area. Avoid elevated temperatures because products of toxic and corrosive decompositions from TCE may form. Monitor the level of any stabilizer component that may be added to the TCE. (Consult the technical data from the supplier to determine the specifics of any added stabilizer.) If applicable, follow the supplier's recommendation concerning proper rotation of stock, shelf-life requirements, and levels of stabilizers.

ENGINEERING CONTROLS IN THE WORKPLACE: Avoid collecting aluminum fines (very small particles) or chips in a TCE vapor degreaser. Monitor TCE stabilizer levels regularly. Only trained personnel should operate vapor degreasers.

TRANSPORTATION DATA (per 49 CFR 172.101-2):

DOT Hazard Class: ORM-A DOT ID No. UN1710 IMO Class: 6.1
IMO Label: St. Andrew's Cross (X)* DOT Shipping Name: Trichloroethylene DOT Label: None

* Harmful - Stay away from foodstuffs (IMO Label, Materials of Class 6.1 Packaging Group III).

References: 1-9, 12, 14, 21, 73, 87-94 PI

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Trichloroethene

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Introduction

Trichloroethene is also known as Triclene and Vitran and by other trade names in industry. It is a nonflammable, colorless liquid at room temperature with a somewhat sweet odor and a sweet, burning taste. This manmade chemical does not occur naturally in the environment. Trichloroethene is now mainly used as a solvent to remove grease from metal parts. It is also used as a solvent in other ways and is used to make other chemicals. Trichloroethene can also be found in some household products, including typewriter correction fluid, paint removers, adhesives, and spot removers. Most people begin to smell trichloroethene in air when there are around 100 parts of trichloroethene per a million parts of air (ppm).

Fate & Transport

By far, the biggest source of trichloroethene in the environment is evaporation from factories that use it to remove grease from metals. It can also enter the air and water when it is disposed of at chemical waste sites. It evaporates easily but can stay in the soil and in groundwater. Once it is in the air, about half will be broken down within a week. When trichloroethene is broken down in the air, phosgene, a lung irritant, can be formed. Under certain conditions found in the workplace, trichloroethene can break down into chemicals such as dichloroacetylene and phosgene. In the body, trichloroethene may break down into dichloroacetic acid (DCA), trichloroacetic acid (TCA), chloral hydrate, and 2-chloroacetaldehyde. These chemical products have been shown to be toxic to animals and are probably toxic to humans. Once trichloroethene is in water, much will evaporate into the air; again, about half will break down within a week. It will take days to weeks to break down in surface water; in groundwater the breakdown is much slower because of the much slower evaporation rate. Very little trichloroethene breaks down in the soil, and it can pass through the soil into underground water. It is found in some foods; the trichloroethene found in foods is believed to come from contamination of the water used in food processing, or from the food processing equipment cleaned with trichloroethene. It does not build up in fish, but it has been found at low levels in them. It is not likely to build up in your body.

Exposure Pathways

Trichloroethene is found in the outdoor air at levels far less than 1 ppm. When measured several years ago, some of the water supplies in the United States were found to have trichloroethene. The most recent monitoring study found mean levels in surface water ranging from 0.0001 to 0.001 parts of trichloroethene per million parts (ppm) of water and a mean level of 0.007 ppm in groundwater. About 400,000 workers are exposed to trichloroethene in the United States on a full-time (i.e., a 40-hour workweek) basis. The chemical can also get into the air or water in many ways, for example, at waste treatment facilities; by evaporation from paints, glues, and other products; or by release from factories where it is made.

Another way you may be exposed is by breathing the air around factories that use the chemical. People living near hazardous waste sites may be exposed to it in the air or in their drinking water, or in the water used for bathing or cooking. Products that may contain trichloroethene are some types of typewriter correction fluids, paints and paint removers, glues, spot removers, rug cleaning fluids, and metal cleaners.

Metabolism

Trichloroethene enters your body when you breathe air or drink water containing it. It can also enter your body if you get it on your skin. You could be exposed to contaminated water or air if you live near or work in a factory that uses trichloroethene or if you live near a waste disposal site that contains trichloroethene. If you breathe the chemical, about half the amount you breathe in will get into your bloodstream and organs; you will exhale the rest. If you drink trichloroethene, most of it will be absorbed into your blood. If trichloroethene comes in contact with your skin, some of it can enter your body, although not as easily as when you breathe or swallow it.

Once in your blood, your liver changes much of the trichloroethene into other chemicals. The majority of these breakdown products leave your body in the urine within a day. You will also quickly breathe out much of the trichloroethene that is in your bloodstream. Some of the trichloroethene or its breakdown products can be stored in body fat for a brief period, and thus may build up in your body if exposure continues.

Health Effects

Trichloroethene was once used as an anesthetic for surgery. People who are exposed to large amounts of trichloroethene can become dizzy or sleepy and may become unconscious when exposed to very high levels. Death may occur from inhalation of large amounts. Many people have jobs where they work with trichloroethene and can breathe it or get it on their skin. Some people who get concentrated solutions of trichloroethene on their skin develop rashes. People who breathe moderate levels of trichloroethene may have headaches or dizziness. Some people who breathe high levels of trichloroethene may develop damage to some of the nerves in the face. Humans have reported health effects when exposed to the level of trichloroethene at which its odor is noticeable. Effects have also occurred at much higher levels. Animals that were exposed to moderate levels of trichloroethene had enlarged livers, and high-level exposure caused liver and kidney damage. However, we do not know if these changes would occur in humans.

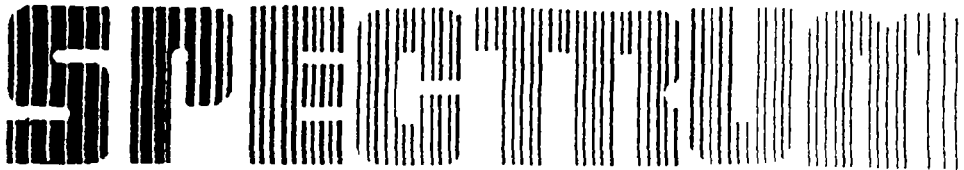
It is uncertain whether people who breathe air or drink water containing trichloroethene are at higher risk of cancer or if their children have more birth defects. People who used water for several years from two wells that had high levels of trichloroethene may have had a higher incidence of childhood leukemia than other people. Increased numbers of children were reported to be born with cardiac abnormalities, a finding which is supported by data from some animal studies showing developmental effects of trichloroethene on the heart. However, other chemicals were also in the water from this well. We do not have any clear evidence that trichloroethene alone can cause leukemia or any other type of cancer in humans. As part of the National Exposure Registry, the Agency for Toxic Substances and Disease Registry (ATSDR) compiled data on 4,280 residents of three states (Michigan, Illinois, and Indiana) who had environmental exposure to trichloroethene. It found no definitive evidence for an excess of cancers from trichloroethene exposure. In studies using high doses of trichloroethene in rats and mice, tumors in the lung, liver, and testes were found, providing some evidence that high doses of

trichloroethene can cause cancer in experimental animals. We do not know if trichloroethene affects human reproduction.

Information excerpted from

Toxicological Profile for Trichloroethene August 1995 Draft Update

Agency for Toxic Substances and Disease Registry
United States Public Health Service



Chemical Fact Sheet

Chemical Abstract Number (CAS #)	79016
Synonyms	Trichloroethylene Trichloroethene Ethene, trichloro Ethylene trichloride TCE
Analytical Methods	EPA Method 502.2 EPA Method 503.1 EPA Method 524.1 EPA Method 524.2 EPA Method 601 EPA Method 624 EPA Method 8010B EPA Method 8021A EPA Method 8240B EPA Method 8260A
Molecular Formula	C_2HCl_3
Use	<p>IN DEGREASING, IN DRY CLEANING: IN MFG ORG CHEM & PHARMACEUTICALS IN GAS PURIFICATION, AS A SOLVENT OF SULFUR & PHOSPHORUS REFRIGERANT & HEAT EXCHANGE LIQUID; DILUENT IN PAINTS & ADHESIVES; TEXTILE PROCESSING; AEROSPACE OPERATIONS (FLUSHING LIQUID OXYGEN) CLEANING SOLVENT, ESP IN VAPOR DEGREASING CHAIN TERMINATOR IN PRODN OF POLYVINYL CHLORIDE SWELLING AGENT IN DISPERSE DYEING OF POLYESTERS AGENT IN REMOVAL OF BASTING THREADS IN TEXTILE PROCESSING CHEM INT FOR 1,1,2,2-TETRACHLOROETHYL SULFENYL CHLORIDE SOLVENT IN ADHESIVES & PAINT-STRIPPING FORMULATIONS HEAT TRANSFER MEDIUM-EG, IN CASE HARDENING OF METALS SOLVENT BASE FOR METAL PHOSPHATIZING SYSTEMS SOLVENT IN CHARACTERIZATION TEST FOR ASPHALT ENTRAINER FOR RECOVERY OF FORMIC ACID EXTRACTION SOLVENT-EG, FOR CAFFEINE Used as household cleaner; with trichloroethane it is used in most typewriter correction fluid. /SRP: Former use Used in wool-fabric scouring Extractant for spice oleoresins. Intermediate in the production of pentachloroethane. Carrier solvent for the active ingredients of insecticides, and fungicides. Medication (Vet): Inhalation anesthetic. Former use</p>
Demand: (1982): 240 million pounds; (1983): Est 235 million pounds; 1987: Est 215	

Consumption Patterns	million pounds. Vapor degreasing of fabricated metal parts, 80%; chemical intermediate, 5%; miscellaneous used, 5%; exports, 10% (1985) Vapor degreasing of fabricated metal parts, 66%; chemical intermediates, miscellaneous domestic uses, 5%; exports, 22%. CLEANING SOLVENT, 89%; CHAIN TERMINATOR, 9%; OTHER, 2% (1980 EST)
Apparent Color	CLEAR, COLORLESS, OR BLUE MOBILE LIQUID
Odor	Ethereal odor, CHLOROFORM-LIKE ODOR; Sweet odor
Boiling Point	87 DEG C
Melting Point	-73 DEG C
Molecular Weight	131.40
Density	1.4649 @ 20 DEG C/4 DEG C
Odor Threshold Concentration	10 mg/l (in water) Purity not specified 5.00X10 ⁻¹ mg/l (liquid) (detection in water) 2.14X10 ⁻¹ ppm (recognition in air) (chemically pure)
Sensitivity Data	Exposure to trichloroethylene vapor may cause irritation of the eyes, nose, and throat. Liquid: irritating to skin and eyes.
Drinking Water Impact	SURFACE WATER: 1-24 ppb industrial rivers in US, with Lake Erie - 188 ppb, 88 of

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Drinking Water and Health

As part of the Drinking Water and Health pages, this fact sheet is part of a larger publication:

National Primary Drinking Water Regulations

Technical Factsheet on: TRICHLOROETHYLENE

Drinking Water Standards

MCLG: zero

MCL: 0.005 mg/L

HAL(child): none

Health Effects Summary

Acute: EPA has found trichloroethylene to potentially cause vomiting and abdominal pain from acute exposures at levels above the MCL.

No Health Advisories have been established for short-term exposures.

Chronic: Trichloroethylene has the potential to cause liver damage from a lifetime exposure at levels above the MCL.

Cancer: There is some evidence that trichloroethylene may have the potential to cause cancer from a lifetime exposure at levels above the MCL.

Usage Patterns

Production of trichloroethylene has increased from just over 260,000 lbs in 1981 to 320 million lbs. in 1991. Vapor degreasing of fabricated metal parts and some textiles accounts for 80% of its use.

Five percent is used as an intermediate in the production of organic chemicals and pharmaceuticals. Miscellaneous uses (5%) include solvents for dry cleaning, extraction and as a refrigerant/heat exchange liquid. An estimated 10% is exported.

Release Patterns

Major environmental releases of trichloroethylene are due to air emissions from metal

degreasing plants. Wastewater from metal finishing, paint and ink formulation, electrical/electronic components, and rubber processing industries also may contain trichloroethylene.

From 1987 to 1993, according to the Toxics Release Inventory, trichloroethylene releases to water totalled over 100,000 lbs. Releases to land totalled over 191,000 lbs. These releases were primarily from steel pipe and tube manufacturing industries. The largest releases occurred in Pennsylvania and Illinois. The largest direct releases to water occurred in West Virginia.

Environmental Fate

Relatively high vapor pressure and low adsorption coefficient to a number of soil types indicates ready transport through soil and low potential for adsorption to sediments. The mobility in soil is confirmed in soil column studies and river bank infiltration studies. Four to six percent of environmental concentrations of trichloroethylene adsorbed to two silty clay loams ($K_{oc} = 87$ and 150). No adsorption to Ca-saturated montmorillonite and 17% adsorption to Al-saturated montmorillonite was observed.

The high Henry's Law Constant indicates rapid evaporation from water. Half-lives of evaporation have been reported to be on the order of several minutes to hours, depending upon the turbulence. Field studies also support rapid evaporation from water. Trichloroethylene is not hydrolyzed by water under normal conditions. It does not adsorb light of less than 290 nm and therefore should not directly photodegrade. However, slow (half-life -10.7 months) photooxidation in water has been noted.

Trichloroethylene is relatively reactive under smog conditions with 60% degradation in 140 min and 50% degradation in 1 to 3.5 hours reported. Atmospheric residence times based upon reaction with hydroxyl radical is 5 days (6-8) with production of phosgene, dichloroacetyl chloride, and formyl chloride.

Marine monitoring data only suggest moderate bioconcentration (2-25 times). Bioconcentration factors of 17 to 39 have been reported in bluegill sunfish and rainbow trout.

Chemical/Physical Properties

CAS Number: 79-01-6

Color/ Form/Odor: Clear, colorless or blue mobile liquid with sweet chloroform-like odor

M.P.: -73 C B.P.: 87 C

Vapor Pressure: 57.8 mm Hg at 20 C

Density/Spec. Grav.: 1.465 at 20 C

Octanol/Water Partition (K_{ow}): Log $K_{ow} = 2.29$

Solubilities: 1.0 g/L of water at 25 C

Soil sorption coefficient: Log Koc = 2 for many soil types; high to very high mobility in soil

Bioconcentration Factor: 17 to 39 in fish; moderate.

Odor/Taste Thresholds: N/A

Henry's Law Coefficient: 0.01 atm-cu m/mole

Trade Names/Synonyms: 1,1,2-Trichloroethylene; Acetylene trichloroethylene; Algylen; Anameth; Benzinol; Chlorilen; CirCosolv; Germalgene; Lethurin; Perm-a-chlor; Petzinol; Philex; TRI-Plus M; Vitran

Other Regulatory Information

Monitoring:

-- For Ground/Surface Water Sources:

Initial Frequency- 4 consecutive quarterly samples during initial compliance period (1993-1995)

Repeat Frequency- If no detects in initial samples GW systems must take annual samples during 1996-1998 compliance period and triennial samples thereafter; SW systems must take annual samples.

-- Triggers - Return to quarterly monitoring if detect at > 0.0005 mg/L, until primacy State determines otherwise

Analysis

<u>Reference Source</u>	<u>Method Numbers</u>
EPA 600/4-88-039	502.2; 524.2; 551

Treatment/Best Available Technologies: Granular Activated Charcoal and Packed Tower Aeration

Toxic Release Inventory - Releases to Water and Land, 1987 to 1993 (in pounds):

	Water	Land
TOTALS (in pounds)	100,293	191,088

Top Six States*

PA	0	33,450
IL	0	30,711
GA	3,742	17,532
TX	0	21,000
MA	0	19,920
WV	12,822	0

Major Industries

Steel pipe, tubes	31	39,288
Misc. Indust. Organics	27,708	0
Car parts, access.	4,405	19,920
Plating, polishing	3,342	20,100
Wool fabric mills	3,942	18,081

* State totals only include facilities with releases greater than 10,000 lbs.

For Additional Information

EPA can provide further regulatory or other general information:

EPA Safe Drinking Water Hotline - 800/426-4791

Other sources of toxicological and environmental fate data include:

Toxic Substance Control Act Information Line - 202/554-1404

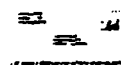
Toxics Release Inventory, National Library of Medicine - 301/496-6531

Agency for Toxic Substances and Disease Registry - 404/639-6000

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Revised *October 13, 1999*

Office of Ground Water and Drinking Water

<http://www.epa.gov/OGWDW/dwh/t-voc/trichlor.html>

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Material Safety Data Sheets Collection:

Sheet No. 703
1,2-Dichloroethylene

Issued: 4/90

Section 1. Material Identification

31

1,2-Dichloroethylene Description: An industrial solvent composed of 60% cis- and 40% trans-isomers. Both isomers, cis and trans, are made by partial chlorination of acetylene. Used as a general solvent for organic materials, lacquers, dye extraction, thermoplastics, organic synthesis, and perfumes. The trans-isomer is more widely used in industry than either the cis-isomer or the mixture. Toxicity also varies between the two isomers.

Other Designations: CAS No. 0540-59-0; $C_2H_2Cl_2$; acetylene dichloride; cis-1,2-dichloroethylene; sym-dichloroethylene; trans-1,2-dichloroethylene, dioform.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*TM for a suppliers list.

R 1
I 2
S 2
K 1



HMIS
H 2
F 3
R 1
PPG*
* Sec. 3

Section 2. Ingredients and Occupational Exposure Limits

1,2-Dichloroethylene, ca 100%

OSHA PEL

8-hr TWA: 790 mg/m³, 200 ppm

ACGIH TLV, 1989-90

TLV-TWA: 790 mg/m³, 200 ppm

NIOSH REL, 1987

790 mg/m³, 200 ppm

Toxicity Data*

Rat, oral, LD₅₀: 770 mg/kg; toxic effects not yet reviewed
Frog, inhalation, TC₅₀: 117 mg/m³ inhaled for 1 hr affects the peripheral nerve and sensation (flaccid paralysis without anesthesia); behavior (excitement); lungs, thorax, or respiration (respiratory depression);

* See NIOSH, RTECS (KV9360000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: 119 °F/48 °C

Melting Point: -56 to -115 °F/-49 to -82 °C/

Vapor Pressure: 180 to 264 torr at 68 °F/20 °C

Vapor Density (Air = 1): 3.4

Molecular Weight: 96.95 g/mol

Specific Gravity (H₂O = 1 at 39 °F/4 °C): 1.27 at 77 °F/25 °C

Water Solubility: Insoluble

Appearance and Odor: A colorless, low-boiling liquid with a pleasant odor.

Section 4. Fire and Explosion Data

Flash Point: 37 °F/2.8 °C, CC

Autoignition Temperature: 860 °F/460 °C

LEL: 5.6% v/v

UEL: 12.8% v/v

Extinguishing Media: Use dry chemical, CO₂, halon, water spray, or standard foam. Water may be ineffective unless used to blanket the fire.

Unusual Fire or Explosion Hazards: This material's vapors are a dangerous fire hazard and moderate explosion hazard when exposed to any heat or ignition source or oxidizer.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and a fully encapsulating suit. Vapors may travel to heat or ignition sources and flash back. Stay upwind and out of low areas. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: This material is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: This material is incompatible with alkalis, nitrogen tetroxide, difluoromethylene, strong oxidizers, and dihydrofluoride. When in contact with copper or copper alloys or by reaction with potassium hydroxide, explosive chloroacetylene may be released.

Conditions to Avoid: Addition of hot liquid to cold 1,2-dichloroethylene may cause sudden emission of vapor that could flash back to an ignition source.

Hazardous Products of Decomposition: Thermal oxidative decomposition of 1,2-dichloroethylene can produce highly toxic fumes of chlorine (Cl₂).

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists 1,2-dichloroethylene as a carcinogen.

Summary of Risks: 1,2-Dichloroethylene's most important effect is its irritation of the central nervous system (CNS) and narcosis. This material is toxic by inhalation, ingestion, and skin contact. It is also irritating to the eyes. The trans-isomer at 2200 ppm causes nausea, vertigo, and burning of the eyes. The trans-isomer is twice as potent as the cis-isomer. If renal effects occur, they are transient.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Target Organs: Central nervous system, eyes, respiratory system.

Primary Entry Routes: Inhalation, ingestion, skin and eye contact.

Acute Effects: Inhalation of 1,2-dichloroethylene causes narcosis, respiratory tract irritation, nausea, vomiting, tremor, weakness, central nervous depression, and epigastric (the abdomen's upper midregion) cramps. Contact with the liquid causes eye and skin (on prolonged contact) irritation. Ingestion causes slight depression to deep narcosis.

Chronic Effects: None reported.

FIRST AID

Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin: Quickly remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed. Have trained personnel administer 100% oxygen, preferably with humidification.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have a conscious person drink 1 to 2 glasses of water, then induce repeated vomiting until vomit is clear.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Physician's Note: Intravenous injections of calcium gluconate may relieve cramps and vomiting. Treat central nervous system effects symptomatically.

Section 7. Spill, Leak, and Disposal Procedures

Leak: Design and practice a 1,2-dichloroethylene spill control and countermeasure plan (SCCP). Notify safety personnel, remove all heat and ignition sources, evacuate hazard area, and provide adequate ventilation. Cleanup personnel should protect against vapor inhalation and skin or eye contact. Absorb small spills on paper towels. After evaporating the 1,2-dichloroethylene from these paper towels in a fume hood, burn the paper in a suitable location away from combustible material. Collect and atomize large quantities in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 100 lb (45.4 kg) [* per RCRA, Sec. 3001, per Clean Water Act, Sec. 307(a)]†

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1)

† Listed as 1,2-trans-dichloroethylene.

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or non-routine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.

Warning: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. 1,2-dichloroethylene attacks some forms of plastics, rubber, and coatings.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PEL and ACGIH TLV (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰⁷⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area; soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, well-ventilated area away from all incompatible materials (Sec. 5) and oxidizing materials. Outside or detached storage is preferred. If stored inside, place containers in a standard flammable liquids storage cabinet or room. Protect containers from physical damage.

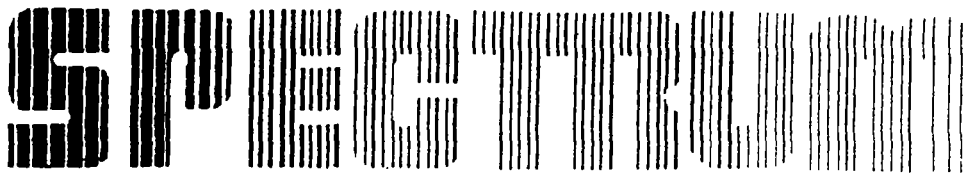
Engineering Controls: Avoid vapor inhalation and skin and eye contact. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. 1,2-dichloroethylene is a dangerous fire hazard. All engineering systems should be of maximum explosion-proof design and electrically grounded and bonded. Provide preplacement questionnaires which emphasize detecting a history of chronic respiratory disease.

Transportation Data (49 CFR 172.101, .102): Not listed

MSDS Collection References: 7, 26, 38, 73, 34, 85, 37, 88, 100, 101, 103, 109, 126, 127, 136, 137

Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD

F7



Chemical Fact Sheet

Chemical Abstract Number (CAS #)	156592
Synonyms	cis-1,2-Dichloroethene cis-1,2-Dichloroethylene
Analytical Methods	<u>EPA Method 502.2</u> <u>EPA Method 524.1</u> <u>EPA Method 524.2</u> <u>EPA Method 8021A</u>
Molecular Formula	$C_2H_2Cl_2$
Use	SOLVENT & CHEMICAL INTERMEDIATE. SOLVENT (AS ISOMERIC MIXT) FOR PERFUMES, DYES, & LACQUERS. SOLVENT (AS MIXT) FOR THERMOPLASTICS, FATS, & PHENOLS. SOLVENT (AS MIXT) FOR CAMPHOR & NATURAL RUBBER. CHEM INT (AS ISOMERIC MIXT) FOR CHLORINATED CMPD. AGENT IN RETARDING FERMENTATION. Used as a solvent for waxes, resins, and acetylcellulose. It is also used in the extraction of rubber, as a refrigerant, in the manufacture of pharmaceuticals and artificial pearls and in the extraction of oils and fats from fish and meat. 1,2-Dichloroethylene CIS- & TRANS-ISOMERS OF 1,2-DICHLOROETHYLENE HAVE HAD USE AS SOLVENTS & CHEM INTERMEDIATES. NEITHER OF ISOMERS HAS DEVELOPED WIDE INDUSTRIAL USAGE IN THE US PARTLY BECAUSE OF THEIR FLAMMABILITY. CIS AND TRANS ISOMERS
Apparent Color	Liquid; Colorless
Boiling Point	60.3 DEG C @ 760 MM HG
Melting Point	-80.5 DEG C
Molecular Weight	96.94
Density	1.2837 @ 20 DEG C/4 DEG C
Sensitivity Data	1,2-Dichloroethylene is an eye irritant. 1,2-Dichloroethylene
Environmental Impact	Cis-1,2-dichloroethylene may be released to the environment in emissions and wastewater during its production and use. Under anaerobic conditions that may exist in landfills or sediment, one is likely to find 1,2-dichloroethylenes that are formed as breakdown products from the reductive dehalogenation of trichloroethylene and tetrachloroethylene. The cis-1,2-dichloroethylene is apparently the more common isomer found although it is mistakenly listed as the trans isomer. The trans isomer, being a priority pollutant is more commonly analyzed for and the analytical procedures generally used do not distinguish the isomers. If cis-1,2-dichloroethylene is released on soil, it should evaporate and/or leach into the groundwater where very slow biodegradation should occur. If released into water, cis-1,2-dichloroethylene will

be lost mainly through volatilization (half life 3 hr in a model river). Biodegradation, adsorption to sediment, and bioconcentration in aquatic organisms should not be significant. In the atmosphere cis-1,2-dichloroethylene will be lost by reaction with photochemically produced hydroxyl radicals (half life 8 days) and scavenged by rain. Because it is relatively long lived in the atmosphere, considerable dispersal from source areas should occur. The general population is exposed to cis-1,2-dichloroethylene in urban air as well as in contaminated drinking water from ground water sources. Occupational exposure will be via dermal contact with the vapor and liquid or via inhalation.

Environmental Fate

TERRESTRIAL FATE: If cis-1,2-dichloroethylene is released on soil, it should evaporate and/or leach into the groundwater where very slow biodegradation should occur. AQUATIC FATE: If released into water, cis-1,2-dichloroethylene will be lost mainly through volatilization (half life 3 hr in a model river). Biodegradation and adsorption to sediment should not be significant. ATMOSPHERIC FATE: In the atmosphere cis-1,2-dichloroethylene will be lost by reaction with photochemically produced hydroxyl radicals (half-life 8 days). There is evidence that it will be scavenged by rain which is to be expected of a water soluble chemical.

Drinking Water Impact

Evaporation from water at 25 deg C of 1 ppm solution: 50% after 24 min, 90% after 83 min. 1,2-Dichloroethylene DRINKING WATER: Cis-1,2-dichloroethylene was found in Miami drinking water at 16 ppb and Cincinnati and Philadelphia drinking water at 0.1 ppb, but was absent from 7 other drinking waters surveyed. GROUNDWATER: Raw water from a well in Wausau, WI contained 83.3 ppb of cis-1,2-dichloroethylene. Studies of the contaminants in shallow groundwater at the Miami Drum site, an inactive drum recycling facility, reported 839 and 13.3-17.9 ppb of cis-1,2-dichloroethylene. The Biscayne aquifer, that supplies drinking water to residents of Dade County contained 0-26 ppb of cis-dichloroethylene in the vicinity of the Miami Drum site. SURFACE WATER: Cis 1,2- dichloroethylene was found along a 30 km stretch of the Glatt River in Switzerland at load levels of 1 g/hr. EFFL: In a comprehensive survey of wastewater from 4000 industrial and publicly owned treatment works (POTWs) sponsored by the Effluent Guidelines Division of the USEPA, cis-1,2-dichloroethylene was identified in discharges of the following industrial category (frequency of occurrence; median concn in ppb): steam electric (1: 1.6), leather tanning (1: 3.3), iron and steel mfg (2: 1400.8), nonferrous metals (1: 314.6), organics and plastics (2: 121.5), textile mills (1: 8.3), plastics and synthetics (3: 20.1), rubber processing (1: 712.0), explosives (1: 1.5). The highest effluent concn was 2059 ppb in the iron and steel mfg industry.

DISCLAIMER - Please Read

Material Safety Data Sheet

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GENIUM PUBLISHING CORP.

No. 382

VINYL CHLORIDE
(Revision A)
Issued: August 1978
Revised: August 1988

SECTION 1. MATERIAL IDENTIFICATION

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Material Name: VINYL CHLORIDE

Description (Origin/Uses): Widely used to make PVC resins and plastics; also used in organic synthesis.

Other Designations: VCM; Vinyl Chloride Monomer; Chloroethylene; Chloroethene; C_2H_3Cl ; CAS No. 0075-01-4

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek* Buyers' Guide (Genium ref. 73) for a list of suppliers.



NFPA

HMIS

H 2

F 4

R 1

PPG*

*See sect. 8

R 1

I 4

S 3

K 4

SECTION 2. INGREDIENTS AND HAZARDS

%

EXPOSURE LIMITS

Vinyl Chloride, CAS No. 0075-01-4

Ca 100

OSHA PEL
8-Hr TWA: 1 ppm*

ACGIH TLV, 1987-88
TLV-TWA: 5 ppm, 10 mg/m³

Toxicity Data**
Rat, Oral, LD₅₀: 500 mg/kg

*The action level set by OSHA in 29 CFR 1910.1017 is 0.5 ppm. Exposures above this level are strictly regulated by extensive medical record keeping, reporting, surveillance, and other requirements. Consult 29 CFR 1910.1017 for details.

**See NIOSH, RTECS (No. KU9625000), for additional data with references to mutagenic, reproductive, and tumorigenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 61°F (16°C)

Molecular Weight: 107 Grams/Mole

Water Solubility (%): Insoluble

Vapor Density (Air = 1): 2.2

Appearance and Odor: A colorless gas; mild, sweet odor at high concentrations.

SECTION 4. FIRE AND EXPLOSION DATA

LOWER

UPPER

Flash Point and Method

Autoignition Temperature

Flammability Limits in Air

-108.4°F (-78°C)

882°F (472°C)

% by Volume

3.6%

33%

Extinguishing Media: Vinyl chloride gas is a severe fire and explosion hazard; treat any fire involving it as an emergency. Try to shut off the flow of gas. Use a water spray to protect the personnel attempting this and to cool fire-exposed cylinders/containers of vinyl chloride.

Unusual Fire or Explosion Hazards: This heavier-than-air gas can flow along surfaces, reach distant sources of ignition, and flash back. Eliminate sources of ignition in the workplace, particularly in low-lying areas such as sumps, cellars, basement utility rooms, and underground piping systems.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Vinyl chloride is stable in closed, airtight, pressurized containers at room temperature under normal storage and handling conditions. It can undergo hazardous polymerization if it is heated or reacted with a polymerization catalyst, or if the concentration/activity of the added inhibitor becomes too low.

Chemical Incompatibilities: This material is incompatible with copper, aluminum, and other polymerization catalysts or free radical initiators like hydroquinone.

Conditions to Avoid: Do not allow sources of ignition such as open flame, unprotected heaters, lighted tobacco products, electric sparks, or excessive heat in work areas. Avoid prolonged exposure to air, especially in the presence of certain contaminants, because dangerous levels of polyperoxides may accumulate. Avoid exposure to sunlight; if the proper catalytic conditions occur, the vinyl chloride monomer may react with itself and undergo an explosive polymerization reaction. Violent ruptures of containers of this gas can occur.

Hazardous Products of Decomposition: During fires, vinyl chloride may decompose into toxic gases such as hydrogen chloride, carbon monoxide, and phosgene.

SECTION 6. HEALTH HAZARD INFORMATION

Vinyl chloride is listed as a carcinogen by the ACGIH, NTP, and IARC with sufficient epidemiological evidence from human studies. Summary of Risks: Vinyl chloride depresses the central nervous system (CNS), causing effects that resemble mild alcohol intoxication; however, these effects can progress to narcosis, eventual collapse, and even death as the intensity and/or duration of the exposure continues. Thrombocytopenia (decrease in blood platelets) has been reported following exposures.

Medical Conditions Aggravated by Long-Term Exposure: Possible liver effects. Target Organs: Respiratory system, skin, eyes, kidneys, hematopoietic (blood) system, and musculoskeletal system. Primary Entry: Inhalation. Acute Effects: Headache, dizziness, lightheadedness, skin and eye irritation. Chronic Effects: Cancer, especially angiosarcoma of the liver.

FIRST AID: Eyes. Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. Skin. Skin contact with liquid vinyl chloride causes frostbite (cryogenic injury). Treat this accordingly.

Inhalation. Remove the exposed person to fresh air; restore and/or support his or her breathing as needed.

Ingestion. Unlikely.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Treat any vinyl chloride gas leak as an emergency. Preplan emergency responses and make sure all personnel know about them. Notify safety personnel, evacuate all nonessential personnel, provide maximum explosion-proof ventilation, and eliminate all sources of ignition immediately. Make sure cleanup personnel have protection against contact with this material and inhalation of its vapor (see sect. 8). Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations for disposal. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z)

Vinyl chloride is specifically regulated by OSHA at 29 CFR 1910.1017 as a suspected carcinogenic agent.

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, No. U043

CERCLA Hazardous Substance, Reportable Quantity: 1 lb (0.454 kg), per Clean Water Act (CWA), section 307 (a); Clean Air Act (CAA), section 112; and Resource Conservation and Recovery Act (RCRA), section 3001.

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). Respirator: Consult the NIOSH Pocket Guide to Chemical Hazards for general recommendations on respirators. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine use (leaks or cleaning reactor vessels and storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. Warning: Air-purifying respirators will not protect workers in oxygen-deficient atmospheres. Other: Wear impervious gloves; boots; aprons; head covers; and clean, impervious, body-covering clothing to prevent any possibility of skin contact with vinyl chloride. All clothing must be flame resistant. Ventilation: Install and operate general and local ventilation systems powerful enough to maintain airborne levels of vinyl chloride below the OSHA PEL standard cited in section 2. All ventilation systems must be of maximum explosion-proof design, e.g., nonsparking, electrically grounded and bonded. Safety Stations: Make eyewash stations, safety showers, and washing facilities available in areas of use and handling. Contaminated Equipment: Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do not wear contact lenses in any work area. Other: Design all engineering systems to be explosion-proof in areas where vinyl chloride gas may occur. Pressure check all pipes and equipment used with this gas and make sure that all connections are leak tight. Comments: Practice good personal hygiene; always wash thoroughly after using this material. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do not eat, drink, or smoke in any work area.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store vinyl chloride in a cool, dry, well-ventilated area away from sources of ignition and incompatible chemicals. Outside or detached storage is recommended. Shade containers from radiant heat and direct sunlight. Special Handling/Storage: Vinyl chloride is shipped/stored as a pressurized gas in cylinders or tank cars. Protect these containers against physical damage and regularly inspect them for cracks, leaks, or faulty valves. Ground and bond all containers used in shipping/transferring operations. Store cylinders upright; secure them tightly; do not drag or slide them; move them in a carefully supervised manner with a suitable hand truck. Monitor the activity and concentration of the added inhibitor to the vinyl chloride product. Follow your supplier's recommendations concerning proper shelf life, rotation of inventory, and maintenance of purity. Engineering Controls: Make all engineering systems (ventilation, production, etc.) of maximum explosion-proof design. Comments: Perform all operations with vinyl chloride carefully to prevent accidental ignition. Do not smoke in any use or storage area. Maintain the valve protection cap in place until immediately before using vinyl chloride. Insert a check valve or trap into the transferral line to prevent a dangerous backflow into the original container. Use pressure-reducing regulators when connecting cylinders to lower-pressure piping systems. Obtain detailed handling, shipping, and storage information from your supplier. A trained chemist or safety specialist familiar with the physical and chemical properties of this material should be present during all work operations.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Vinyl Chloride

DOT ID No. UN1086

References: 1, 2, 12, 73, 34-94

DOT Label: Flammable Gas

DOT Hazard Class: Flammable Gas

IMO Label: Flammable Gas

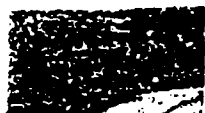
IMO Class: 2.1

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Vinyl chloride

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[Introduction](#) | [Fate and Transport](#) | [Exposure Pathways](#)
[Metabolism](#) | [Health Effects](#)

Introduction

Vinyl chloride is a colorless gas at normal temperatures. It is also known as chloroethene, chloroethylene, ethylene monochloride, or monochloroethylene. It is flammable (easily capable of burning) as a gas and is not stable at high temperatures or pressure. Vinyl chloride will exist in liquid form if it is kept under high pressure. Vinyl chloride has a mild, sweet odor. Most people begin to smell vinyl chloride in the air at 3,000 parts vinyl chloride per million parts (ppm) of air. Most people begin to taste vinyl chloride in water at 3.4 ppm.

All vinyl chloride is man-made or results from the breakdown of other manmade substances, such as trichloroethene, trichloroethane, and tetrachloroethene. Production of vinyl chloride in the United States has grown an average of 7 percent from the early 1980s to the early 1990s, with an additional increase of approximately 22 percent between the years of 1992 and 1993. Most of the vinyl chloride produced in the United States is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products including pipes, wire and cable coatings, and packaging materials. Other uses include furniture and automobile upholstery, wall coverings, housewares, and automotive parts. At one time, vinyl chloride was also used as a coolant, as a propellant in spray cans, and in some cosmetics. Since the mid 1970s, it has not been used for these purposes.

Fate & Transport

Most of the vinyl chloride that enters the environment comes from the plastics industries, which release it into the air or into waste water. EPA limits the amount that industries may release. Vinyl chloride is a breakdown product of other manmade chemicals in the environment. Vinyl chloride has entered the environment at hazardous waste sites as a result of its improper disposal or leakage from storage containers or from spills. Vinyl chloride has been found in tobacco smoke, perhaps as a result of the manufacturing process.

Liquid vinyl chloride evaporates easily into the air. Vinyl chloride in water or soil evaporates rapidly if it is near the surface. Vinyl chloride in the air breaks down in a few days. When vinyl chloride breaks down in air, it can form other harmful chemicals.

A limited amount of vinyl chloride can dissolve in water. It can enter groundwater and can also be found in groundwater from the breakdown of other chemicals. It is unlikely that vinyl chloride will build up in plants or animals that you might eat.

Exposure Pathways

Since vinyl chloride commonly exists in a gaseous state, you are most likely to be exposed to it by breathing it in. Vinyl

chloride is not normally found in urban, suburban, or rural air in amounts that are detectable by the usual methods of analysis. However, vinyl chloride has been found in the air near plastics industries, hazardous waste sites, and landfills. The amount of vinyl chloride in the air near these places ranges from trace amounts to 0.041 ppm of air, but may exceed 1 ppm. Levels as high as 44 ppm have been found at some landfills. One can also be exposed to vinyl chloride in the air through tobacco smoke from cigarettes or cigars.

You may also be exposed to vinyl chloride by drinking water from contaminated wells but how often this occurs is not known. Most drinking water supplies do not contain vinyl chloride. In a 1982 survey, vinyl chloride was found in less than 1 percent of the 945 groundwater supplies tested in the United States. The concentrations found in groundwater were up to 0.008 ppm, with a detection limit of 0.001 ppm. Other studies have reported groundwater vinyl chloride concentrations at or below 0.38 ppm. At one time, the flow of water through PVC pipes added very low amounts of vinyl chloride to water. For example, in one study of newly installed pipes, the drinking water had 0.001 ppm of vinyl chloride. No current information on the amount of vinyl chloride released from PVC pipes into water is available. In the past, vinyl chloride could get into food that was stored in materials that contained PVC. Now the U.S. government regulates the amount of vinyl chloride in food packaging materials. A model of food systems shows that when levels less than 1 ppm of vinyl chloride monomer are used in PVC packaging, "essentially zero" vinyl chloride enters food by contact with these products.

Exposure to vinyl chloride can also occur in the workplace by breathing in any vapors in the air or if it comes into contact with your skin or eyes. Almost 80,000 people work with vinyl chloride at their jobs. This number includes workers who make vinyl chloride and PVC and workers who use PVC to make other objects such as pipes.

Metabolism

If vinyl chloride comes into contact with your skin, negligible amounts may pass through the skin and enter your body. Vinyl chloride is more likely to enter your body when you breathe air or drink water containing it. This could occur near certain factories or hazardous waste sites or in the workplace.

Most of the vinyl chloride that you breathe in or swallow enters your blood rapidly. The vinyl chloride in your blood travels through your body. When some portion of it reaches your liver, it is changed into several different substances. Most of these new substances also travel in your blood. Once they reach the kidneys, they leave your body in your urine. Most of the vinyl chloride is gone from your body a day after you breathe it in or swallow it. The liver, however, makes some new substances that do not leave your body as rapidly. A few of these substances are more harmful than vinyl chloride because they react with chemicals inside your body and interfere with the way your body uses or responds to these chemicals. Some of these substances react in the liver and cause damage there. It takes more time for your body to get rid of these changed chemicals, but eventually your body will remove them as well. If you breathe in or swallow more vinyl chloride than your liver can chemically change, you will breathe out excess vinyl chloride.

Health Effects

If you breathe high levels of vinyl chloride, you will feel dizzy or sleepy. These effects occur within 5 minutes at about 10,000 ppm of vinyl chloride. You can easily smell vinyl chloride at this concentration. If you breathe very high levels, you may pass

out. You can rapidly recover from these effects if you breathe fresh air. Some people get a headache when they breathe fresh air immediately after breathing very high levels of vinyl chloride. People may die if they breathe extremely high levels of vinyl chloride. These levels are much higher than the levels that cause you to pass out.

Studies in animals show that extremely high levels of vinyl chloride can damage the liver, lungs, and kidneys. These levels can also damage the heart and prevent blood clotting. The effects of drinking high levels of vinyl chloride are unknown. If you spill liquid vinyl chloride on your skin, it will numb the skin and cause redness and blisters.

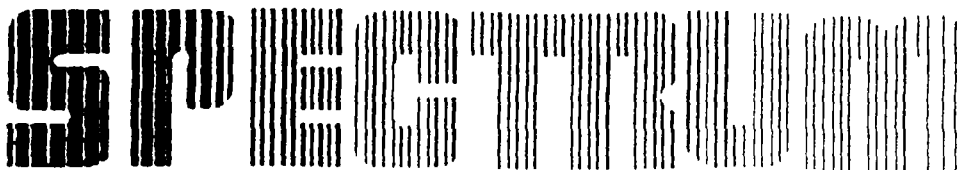
Some people who have breathed vinyl chloride over several years have developed changes in the structure of their livers. People are more likely to develop these changes if they breathe high levels of vinyl chloride. Some people who have worked with vinyl chloride have developed nerve damage, and others have developed an immune reaction. The lowest levels that cause liver changes, nerve damage, and the immune reaction in humans are not known. Certain jobs related to polyvinyl chloride production expose workers to very high levels of vinyl chloride. Some of these workers have problems with the blood flow in their hands. Their fingers turn white and hurt when they go into the cold. It may take a long time to recover when they go into a warm place. In some of these people, changes have appeared on the skin of their hands and forearms. Also, bones at the tips of their fingers have broken down. Studies suggest that some people may be more sensitive to these effects than others.

Some men who work with vinyl chloride have complained of a lack of sex drive. Results of studies in animals show that long-term exposure may damage the sperm and testes. Some women who work with vinyl chloride have had irregular menstrual periods. Some have developed high blood pressure during pregnancy. Studies of women who live near vinyl chloride manufacturing plants could not prove that vinyl chloride causes birth defects. Studies using pregnant animals show that breathing vinyl chloride may harm their unborn offspring. Animal studies also show that vinyl chloride may cause increased numbers of miscarriages early in pregnancy. It may also cause decreased weight and delayed skeletal development in fetuses. The same very high levels of vinyl chloride that caused these fetal effects also caused adverse effects in the pregnant animals.

Results from several studies suggest that breathing air or drinking water containing low levels of vinyl chloride may increase the risk of getting cancer. Studies of workers who have breathed vinyl chloride over many years showed cancer of the liver. Brain cancer, lung cancer, and some cancers of the blood also may be connected with breathing it daily for several years. Studies of long-term exposure in animals show that increases in cancers of the liver and mammary glands may occur at very low levels of vinyl chloride in the air. Studies show that animals fed low levels of vinyl chloride each day during their lifetime had an increased risk of getting liver cancer.

The Department of Health and Human Services has determined that vinyl chloride is a known carcinogen. The International Agency for Research on Cancer has determined that vinyl chloride is carcinogenic to humans, and EPA has determined that vinyl chloride is a human carcinogen.

Information excerpted from
Toxicological Profile for Vinyl chloride August 1995 Update
Agency for Toxic Substances and Disease Registry
United States Public Health Service



Chemical Fact Sheet

Chemical Abstract Number (CAS #)	75014
Synonyms	Vinyl chloride Ethene, chloro-
Analytical Methods	EPA Method 502.2 EPA Method 524.1 EPA Method 524.2 EPA Method 601 EPA Method 624 EPA Method 8010B EPA Method 8021A EPA Method 8240B EPA Method 8260A
Molecular Formula	C_2H_3Cl
Use	<p>IN PLASTIC INDUSTRY: AS REFRIGERANT; IN ORGANIC SYNTHESIS. MONOMER FOR POLY(VINYL CHLORIDE) HOMOPOLYMER. COMONOMER-EG, WITH VINYL ACETATE OR VINYLIDENE CHLORIDE. CHEM INTERMED FOR METHYL CHLOROFORM & 1,1,1-TRICHLOROETHANE. CHEM INTERMED FOR OTHER ORG CHEMS-EG, CHLOROACETALDEHYDE. MONOMER & COMONOMER FOR FIBERS-EG, VINYLON & SARAN FIBERS. OXIDN INHIBITOR IN ETHYLENE OXIDE PRODN. REFRIGERANT & EXTRACTION SOLVENT (FORMER USE). Vinyl chloride is used in the manufacture of numerous products in building and construction, automotive industry, electrical wire insulation and cables, piping, industrial and household equipment, medical supplies, and is depended upon heavily by the rubber, paper, and glass industries. Adhesives for plastics Vinyl chloride was formerly a component of aerosol propellants. Vinyl chloride and vinyl acetate copolymers are used extensively to produce vinyl asbestos floor tiles. Limited quantities of chloroethene were used in the United States as an aerosol propellant and as an ingredient of drug and cosmetic products. (Former use)</p>
Consumption Patterns	<p>MONOMER FOR POLY(VINYL CHLORIDE) RESINS, 85%; EXPORTS, 13.5%; MISCELLANEOUS (MOSTLY COPOLYMER USE), 1.5% (1982) 95% FOR POLYVINYL CHLORIDE HOMOPOLYMER AND COPOLYMER RESIN; 4% FOR SYNTHESIS OF METHYL CHLOROFORM; 1% FOR MISC APPLICATIONS (1972) 91% FOR POLYVINYL CHLORIDE CHEMICAL PROFILE: Vinyl Chloride. Polyvinyl chloride, 91%; exports, 7%; other, including chlorinated solvents, 2%. CHEMICAL PROFILE: Vinyl chloride. Demand: 1988: 9.1 billion lb; 1989: 9.2 billion lb; 1993 /projected/: 11.0 billion lb. (Includes exports, but not imports, which totaled 227 million lb last year.)</p>

Apparent Color	COLORLESS GAS OR LIQUID
Odor	Ethereal odor : Sweet odor
Boiling Point	-13.37 deg C
Melting Point	-153.8 deg C
Molecular Weight	62.50
Density	0.9106 @ 20 DEG C/4 DEG C
Odor Threshold Concentration	Although vinyl chloride has an odor at high concn. it is of no value in preventing excessive exposure. The actual vapor concn that can be detected has never been adequately determined and varies from one individual to another, from impurities in the sample and probably from duration of exposure.
Sensitivity Data	Primary irritant for skin.

Environmental Impact

Although vinyl chloride is produced in large quantities, almost all of it is used captively for the production of polyvinyl chloride (PVC) and other polymers. Therefore, its major release to the environment will be as emissions and wastewater at these production and manufacturing facilities. If vinyl chloride is released to soil, it will be subject to rapid volatilization with reported half-lives of 0.2 and 0.5 days for evaporation from soil at 1 and 10 cm incorporation, respectively. Any vinyl chloride which does not evaporate will be expected to be highly to very highly mobile in soil and it may leach to the groundwater. It may be subject to biodegradation under anaerobic conditions such as exists in flooded soil and groundwater. If vinyl chloride is released to water, it will not be expected to hydrolyze, to bioconcentrate in aquatic organisms or to adsorb to sediments. It will be subject to rapid volatilization with an estimated half-life of 0.805 hr for evaporation from a river 1 m deep with a current of 3 m/sec and a wind velocity of 3 m/sec. In waters containing photosensitizers such as humic acid, photodegradation will occur fairly rapidly. Limited existing data indicate that vinyl chloride is resistant to biodegradation in aerobic systems and therefore, it may not be subject to biodegradation in aerobic soils and natural waters. It will not be expected to hydrolyze in soils or natural waters under normal environmental conditions. If vinyl chloride is released to the atmosphere, it can be expected to exist mainly in the vapor-phase in the ambient atmosphere and to degrade rapidly in air by gas-phase reaction with photochemically produced hydroxyl radicals with an estimated half-life of 1.5 days. Products of reaction in the atmosphere include chloroacetaldehyde, hydrogen chloride, chloroethylene epoxide, formaldehyde, formyl chloride, formic acid, and carbon monoxide. In the presence of nitrogen oxides, eg photochemical smog situations, the half-life would be reduced to approximately a few hours. Since vinyl chloride is primarily used in limited number of locations, it is unlikely that contamination will be widespread. Major human exposure will be from inhalation of occupational atmospheres and from ingestion of contaminated food and drinking water which has come into contact with polyvinyl chloride packaging material or pipe which has not been treated adequately to remove residual monomer.

TERRESTRIAL FATE: If vinyl chloride is released to soil, it will be subject to rapid volatilization based on a reported vapor pressure of 2660 mm Hg at 25 deg C; half-lives of 0.2 and 0.5 days were reported for volatilization from soil incorporated into 1 and 10 cm of soil, respectively. Any vinyl chloride which does not evaporate will be expected to be highly mobile in soil. It may be subject to biodegradation under anaerobic conditions such as exists in flooded soil and groundwater; however, limited existing data indicate that vinyl chloride is resistant to biodegradation in aerobic

Environmental Fate

systems and therefore, it may not be subject to biodegradation in natural waters. It will not be expected to hydrolyze in soils under normal environmental conditions. **AQUATIC FATE:** If vinyl chloride is released to water, it will not be expected to hydrolyze, to bioconcentrate in aquatic organisms or to adsorb to sediments. It will be subject to rapid volatilization with an estimated half-life of 0.805 hr for evaporation from a river 1 m deep with a current of 3 m/sec and a wind velocity of 3 m/sec (1.SRC). In waters containing photosensitizers such as humic acid, photodegradation will occur fairly rapidly. Limited existing data indicate that vinyl chloride is resistant to biodegradation in aerobic systems and therefore, it may not be subject to biodegradation in natural waters. **ATMOSPHERIC FATE:** If vinyl chloride is released to the atmosphere, it can be expected to exist mainly in the vapor-phase in the ambient atmosphere (1.SRC) based on a reported vapor pressure of 2660 mm Hg at 25 deg C. Gas phase vinyl chloride is expected to degrade rapidly in air by reaction with photochemically produced hydroxyl radicals with an estimated half-life of 1.5 days (3.SRC). Products of reaction in the atmosphere include chloroacetaldehyde, HCl, chloroethylene epoxide, formaldehyde, formyl chloride, formic acid, and carbon monoxide. In the presence of nitrogen oxides, eg photochemical smog situations, the half-life would be reduced to a few hours. **AQUATIC FATE:** The rate of bulk exchange of gaseous vinyl chloride between atmosphere and water is about twice that of oxygen. As a result the loss of vinyl chloride by volatilization from water is probably the most significant process in its distribution. There is little information pertaining specifically to the rate of adsorption onto particulate matter. In a study on the behavior of vinyl chloride in water no significant difference in the rate of loss from distilled water, river water, or effluent from a vinyl chloride plant stirred at the same rate was found, thus indicating negligible adsorption onto particulate matter. Aquatic sediments could exhibit long-term storage of low levels if extreme environmental conditions, such as continual high levels of vinyl chloride input were present in water. **AQUATIC FATE:** In environments such as municipal water chlorination facilities, high concentrations of chloride would exist. Under certain conditions, vinyl chloride may be converted to more highly chlorinated compounds based on the reactivity of carbon-carbon double bonds with chlorine and hypochlorous acid. Dissolved vinyl chloride in water will readily escape into the gas phase, but chemical reactions can occur with water impurities which may inhibit its release. Many salts have the ability to form complexes with vinyl chloride and can increase its solubility. Therefore, the amounts of vinyl chloride in water could be influenced significantly by the presence of salts.

DRINKING WATER: In the National Organic Monitoring Survey (1976-7) 2 samples out of 113 contained detectable levels (>0.1 ppb) and these averaged 0.14 ppb. Highest value found in USA drinking water is 10 ppb (5.7). 23% of 133 USA cities using finished surface water were pos. 0.1 to 9.8 ppb, 0.4 ppb median of pos samples. A finished groundwater survey in 25 USA cities resulted in 4.0% pos. 9.4 ppb mean (2.6). One contaminated drinking water well contained 50 ppb. Drinking water from PVC pipes contained 1.4 ppb in a recent installation, while a 9 yr old system had 0.03 to 0.06 ppb. **DRINKING WATER: USA: National Screening Program, 1977-1981,** 142 water supplies, 4.9% pos. trace to 76 ppb; state sampling data, 1033 supplies sampled, 7.1% pos. trace to 380 ppb. **GROUNDWATER:** 4 of 1060 wells in New Jersey were positive. Vinyl chloride (VC) was present in the 10 most polluted wells from 408 New Jersey samples; however, vinyl chloride was not quantified. 15.4% of 13 US cities sampled were pos - 2.2 to 9.4 ppb, 5.8 ppb median (1.2). In a 9-state survey, 7% of the wells tested were positive, with a maximum value of 380 ppb reported. After train derailment in Manitoba on Mar 10,

Drinking Water Impact

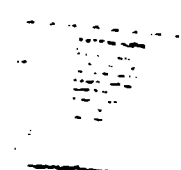
1980, in which large amounts of VC was spilled in the snow, 10 ppm max occurred in groundwater which decreased to below 0.02 ppm by 10 wk after the spill(6).
GROUNDWATER: USA 1982 National Ground Water Supply Survey, 466 samples, 1 sample pos at 1.1 ppb (1 ppb quantification limit). SURFACE WATER: 9.8 ppb max value found in a 1981, 9 state survey(2,3). It was not detected in winter or summer samples from the Delaware River. Vinyl chloride has been detected in 21 out of 606 samples from New Jersey and other USA samples(6). 7.6% of 105 USA cities were positive with pos samples ranging from 0.2 to 5.1 ppb, 3.25 ppb median. On the basis of various model simulations it appears that vinyl chloride should not remain in the aquatic ecosystem under most natural conditions. The loss of vinyl chloride at constant temperature and pressure is a function of water turbulence and mixing efficiency. Experimental decrease of 16 mg/l is 96% in 2 hours when stirred rapidly at 22 deg C in an open beaker of distilled water. In contrast, quiescent water under the same conditions yielded a concn loss over 2 hours of only 25%. Assuming that all processes involved are strictly first order, the volatilization loss data above yields half-lives of 25.8 minutes for the stirred case and 290 minutes for the quiescent case. EFFL: The only industry with appreciable waste water effluents of vinyl chloride is the organic chemicals mfg/plastic industry where mean levels are 750 ppb. Waste water from 12 PVC plants in 7 USA areas ranged from 0.05 to 20 ppm with typical levels being 2 to 3 ppm. Vinyl chloride has been detected in effluents from chemical and latex plants in Long Beach, California. It was not detected in effluents from major municipal waste water discharges in Southern California. Groundwater from hazardous waste sites, CERCLA Database, 178 sites, 8.7% pos for vinyl chloride.

DISCLAIMER - Please Read

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SUPERFUND CHEMICAL DATA MATRIX

EXHIBIT BDate: 4/1/88
Chemical: Trichloroethylene

CAS Number: 000078-01-8

TOXICITY

Parameter	Value	Unit	Source
Oral RfD:		mg/kg/day	C_EENV
Inhal RfD:		mg/kg/day	LIVEC
Oral Slope:	1.10E-02	(mg/kg/day) ⁻¹	
Oral Vt-of-Evid:	82		SSG_KD
Inhal Slope:		(mg/kg/day) ⁻¹	
Inhal Vt-of-Evid:			
Oral ED10:	1.00E+01	mg/kg/day	EPA_ED10
Oral ED10 Wgt:	82		
Inhal ED10:	1.00E+01	mg/kg/day	EPA_ED10
Inhal ED10 Wgt:	82		
Oral LD50:	2.40E+03	mg/kg	C_EENV
Dermal LD50:	2.00E+04	mg/kg	
Gas Inhal LC50:	8.46E+03	ppm	RTECS
Dust Inhal LC50:	3.25E+01	mg/l	RTECS
ACUTE			
Fresh AWQC:		ug/L	
Salt AWQC:		ug/L	
Fresh AALAC:		ug/L	
Salt AALAC:		ug/L	
CHRONIC			
Fresh AWQC:		ug/L	
Salt AWQC:		ug/L	
Fresh AALAC:		ug/L	
Salt AALAC:		ug/L	
Fresh Ecol LC50:	1.90E+03	ug/L	AQUIRE
Salt Ecol LC50:	1.40E+04	ug/L	AQUIRE

PERSISTENCE

Parameter	Value	Unit	Source
LAKE - Half-lives			
Hydrolysis:	4.75E+08	days	FATE
Volatility:	1.01E+02	days	THOMAS
Photolysis:		days	
Biodeg:	3.60E+02	days	FATERATE
Radio:		days	
RIVER - Half-lives			
Hydrolysis:	4.75E+08	days	FATE
Volatility:	1.09E+00	days	THOMAS
Photolysis:		days	
Biodeg:	3.60E+02	days	FATERATE
Radio:		days	
Log Kow:	2.71E+00		RTI_LOGP

PHYSICAL CHARACTERISTICS

Parameter	Value
Metal Contain:	FALSE
Organic:	TRUE
Gas:	TRUE
Particulate:	FALSE
Radionuclide:	FALSE
Rad. Element:	FALSE
Molecular Weight:	1.31E+02
Density:	1.46E+00 g/mL @ 20.00 C

MOBILITY

Parameter	Value	Unit	Source
Vapor Press:	7.35E+01	Torr	CHEMFATE
Henry's Law:	1.03E-02	atm-m ³ /mol	CHEMFATE
Water Solub:	1.10E+03	mg/L	LIVECHEM
Distrib Coef:	3.32E-01	mg/g	SSG_KD
Geo. Mean Sol:			

BIOACCUMULATION

Parameter	Value	Unit	Source
FOOD CHAIN			
Fresh BCF:	1.70E+01		VER_BCF
Salt BCF:			VER_BCF
ENVIRONMENTAL			
Fresh BCF:	1.70E+01		
Salt BCF:			
Log Kow:	2.71E+00		RTI_LOGP
Water Solub:	1.10E+03		LIVECHEM

OTHER DATA

Melting Point:	-84.70 C
Boiling Point:	87.20 C
Formula:	C2 H Cl3

CLASS INFORMATION

Class: Parent Substance
 Toxicity:
 GW Mob:
 Other:



EXHIBIT C

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Trichloroethylene
PRODUCT ID: 44002
SYNONYMS: Trichloroethene; Trichloroethylene; Trichlor; C_2HCl_3
DATE: 10/16/1997
EDITION NO.: 015

PPG Industries, Inc.
One PPG Place, Pittsburgh, PA 15272, USA

24-hour Emergency Telephone Number: 1-304-843-1300

For Product Information (8am-5pm Eastern time): 1-800-243-6774 (C/A)

PREPARER: R. Kenneth Lee, Manager, Product Safety

2. COMPOSITION/INFORMATION ON INGREDIENTS

Material/CAS Number	Percent
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Trichloroethylene (Stabilized) 79-01-6	>99
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Note: Tested Mixture

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

WARNING! Keep away from food. Vapor harmful.
Do not ship lightly stabilized grades in aluminum trailers.

Precautions: Do not swallow. Swallowing may cause injury or death. Avoid contact with eyes. Will cause irritation and pain. Avoid prolonged, repeated, or excessive contact with skin. May cause irritation and dermatitis. Do not breathe vapors. High vapor concentrations can cause dizziness, unconsciousness, central nervous system depression or death. Long-term overexposure may cause liver/kidney injury. Do not use in poorly ventilated or confined spaces without proper respiratory protection. Use with adequate ventilation. Ventilation must be sufficient to limit employee exposure to this product below permissible exposure limits. Wash thoroughly every day after work. Do not eat, drink or smoke in work area. Eye irritation, dizziness and/or drunkenness are signs of overexposure.

4. FIRST AID MEASURES

INHALATION: Move person to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

EYE/SKIN CONTACT: In case of contact, immediately flush eyes and skin with plenty of water (soap and water for skin) for at least 15 minutes, while removing contaminated clothing and shoes. Get medical attention if irritation persists. Thoroughly clean contaminated clothing and shoes before reuse or discard.

INGESTION: If swallowed, give at least 3-4 glasses of water, but do not induce vomiting. Do not give anything by mouth to an unconscious or convulsing person. Get medical attention.

NOTES TO PHYSICIAN: Only administer adrenaline after careful consideration following overexposure. Increased sensitivity of the heart to adrenaline may be caused by overexposure to this product.

5. FIRE FIGHTING MEASURES

FLASH POINT: None (by DOT test method).

FLAMMABLE LIMITS IN AIR - LOWER (%): 7.8%

FLAMMABLE LIMITS IN AIR - UPPER (%): 52%

EXTINGUISHING MEDIA: Carbon dioxide. Dry chemical. Water.

SPECIAL FIREFIGHTING PROCEDURES: Emits toxic fumes under fire conditions. When this product is involved in fires, it can decompose to hydrogen chloride and possible traces of phosgene. Fire-fighters must wear NIOSH approved pressure demand, self-contained breathing apparatus and full protective clothing when fighting chemical fires. Vapor concentration in a confined or poorly ventilated area can be ignited upon contact with a high energy spark, flame, or high intensity source

of heat. This can occur at concentrations ranging between the lower and upper limits (by volume) listed above.

6. ACCIDENTAL RELEASE MEASURES

ACTION TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

Immediately evacuate the area. Provide maximum ventilation. Unprotected personnel should move upwind of spill. Only personnel equipped with proper respiratory and eye/skin protection should be permitted in the area. Dike area to contain spill. Take precautions as necessary to prevent contamination of ground and surface waters. Recover spilled material on adsorbents, such as sawdust or vermiculite, and sweep into closed containers for disposal. After all visible traces, including ignitable vapors, have been removed, thoroughly wet vacuum the area. Do not flush to sewer. If area of spill is porous, remove as much earth and gravel, etc. as necessary and place in closed containers for disposal.

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN DURING HANDLING AND STORAGE:

Vapors are heavier than air and will collect in low areas. Keep container closed when not in use. Store only in closed, properly labeled containers. This material or its vapors when in contact with flames, hot glowing surfaces or electric arcs can decompose to form hydrogen chloride gas and traces of phosgene. Avoid contamination of water supplies. Handling, storage and use procedures must be carefully monitored to avoid spills or leaks. Any spill or leak has the potential to cause underground water contamination which may, if sufficiently severe, render a drinking water source unfit for human consumption. Contamination that does occur cannot be easily corrected. A chlorinated solvent used as a flashpoint suppressant must be added in sufficient quantity or the resultant mixture may have a flashpoint lower than the flammable component. Do not use cutting or welding torches on drums that contained this product unless properly purged and cleaned. Do not ship lightly stabilized grades in aluminum trailers. The only exception is Type 145 vapor degreasing grade. Liquid oxygen or other strong oxidants may form explosive mixtures with this product.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Limits:

8-hour Time Weighted Average (TWA); 15-minute Short-Term Exposure Limit (STEL)

OSHA: 50 ppm TWA, 200 ppm STEL. Table Z-2, 29 CFR 1910.1000 (Rev. 3/1/89). NOTE: The currently enforceable 1971 limit is 100 ppm TWA and 200 ppm ceiling.

ACGIH: 50 ppm TWA-100 ppm STEL.

RESPIRATORY PROTECTION: Airborne concentrations should be maintained below the exposure limits. When respiratory protection is required for certain operations (<10x exposure limit), use an air purifying respirator. The effectiveness of an air purifying respirator is limited. Use only for a single short-term exposure. Use self-contained breathing apparatus (SCBA) or full facpiece airino respirator with auxiliary SCBA operated in the pressure demand mode for emergencies and for all work performed in storage vessels, poorly ventilated rooms, and other confined areas. Respirators must be approved by NIOSH. The respiratory use limitations made by NIOSH or the manufacturer must be observed. Respiratory protection programs must be in accordance with 29 CFR 1910.134.

VENTILATION: Use local exhaust or dilution ventilation as appropriate to control exposures to below permissible limits.

EYE AND FACE PROTECTION: Splashproof goggles.

PROTECTIVE GLOVES: Viton®. Silver Shield®. Polyvinyl alcohol (degrades in water).

OTHER PROTECTIVE EQUIPMENT: Boots, aprons, or chemical suits should be used when necessary to prevent skin contact. Personal protective clothing and use of equipment must be in accordance with 29 CFR 1910.132 (general requirements), .133 (eye and face protection), and .138 (hand protection).

9. PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: 86-88 C
VAPOR DENSITY (Air=1): 4.54
SPECIFIC GRAVITY (Water=1): 1.485 @ 20/20 C
pH: 6.7 to 7.5
FREEZING/MELTING POINT: -86.4 C
SOLUBILITY (wt.% in water): 0.11
BULK DENSITY: 12.2 lbs/gal @ 20 C
VOLUME % VOLATILE: 100
VAPOR PRESSURE: 57.8 mm Hg @ 20 C
EVAPORATION RATE: 0.28 (ethyl ether=1)
HEAT OF SOLUTION: NA
PHYSICAL STATE: Liquid
ODOR: Ether-like
COLOR: Clear/Colorless

10. STABILITY AND REACTIVITY

STABILITY: Stable

HAZARDOUS POLYMERIZATION: Will not occur.

INCOMPATIBILITY (CONDITIONS/MATERIALS TO AVOID):

Open flames, hot glowing surfaces or electric arcs. Avoid contamination with caustic soda, caustic potash or oxidizing materials. Shock sensitive compounds may be formed.

HAZARDOUS THERMAL DECOMPOSITION/COMBUSTION PRODUCTS:

Hydrogen chloride gas. Possible traces of phosgene.

11. TOXICOLOGICAL INFORMATION

WARNING: This product is a chemical known to the State of California to cause cancer.

ACUTE INHALATION LC50: . . . (mouse) 8450 ppm (4 hours). Slight to very low toxicity.
ACUTE DERMAL LD50: (rabbit) >20 mg/kg. Slight to very low toxicity.
SKIN IRRITATION: Mildly irritating.
EYE IRRITATION: Moderately irritating.
ACUTE ORAL LD50: (rat) 5650 mg/kg. Slight to very low toxicity.

CHRONIC EFFECTS/CARCINOGENICITY: This product is listed as a carcinogen or potential carcinogen by IARC, but is not listed by NTP or OSHA. This product is listed under IARC as a 2A.

MEDICAL CONDITIONS AGGRAVATED: Prolonged exposure above the OSHA permissible exposure limit may complicate existing liver and kidney diseases.

EFFECTS OF OVEREXPOSURE:

ACUTE:

Inhalation: This product is primarily a central nervous system depressant. Inhalation can cause irritation of the respiratory tract, dizziness, nausea, headache, loss of coordination and equilibrium, unconsciousness and even death in confined or poorly ventilated areas. Fatalities following severe acute exposure to various chlorinated solvents have been attributed to ventricular fibrillation.

Eye/Skin: Liquid splashed in the eye can result in discomfort, pain and irritation. Prolonged or repeated contact with liquid on the skin can cause irritation and dermatitis. The problem may be accentuated by liquid becoming trapped against the skin by contaminated clothing and shoes. Skin absorption is not expected to be of toxicological significance under normal industrial use.

Ingestion: Swallowing of this material may result in irritation of the mouth and GI tract along with other effects as listed above for Inhalation. Vomiting and subsequent aspiration into the lungs may lead to chemical pneumonia and pulmonary edema which is a potentially fatal condition.

CHRONIC: Prolonged exposure above the OSHA permissible exposure limits may result in liver and kidney damage. Prudent handling practices should be followed to minimize human exposure.

CARCINOGENICITY: In a National Cancer Institute bioassay, little if any effect was observed in rats but hepatocellular carcinomas were quite common in both sexes of mice fed high doses. A subsequent study investigating the possible differences in metabolism found that mice metabolized trichloroethylene to a much greater extent than other species. Additionally, data from this study showed that tumor formation occurred via a nongenetic mechanism. The Science Advisory Board of the EPA has suggested caution in concluding from animal studies that trichloroethylene presents a risk of human cancer because of the negative epidemiology studies and also because of metabolism studies showing differences between the human and mouse response.

MUTAGENESIS: When activated with microsomal enzymes, trichloroethylene has been shown to be weakly positive in certain microbial mutagen test systems.

EPIDEMIOLOGY: In a retrospective cohort study of 14,457 people followed for at least 26 years, the investigators concluded that employees occupationally exposed to trichloroethylene did not show any significant association between several measures of exposure to trichloroethylene and any excess of cancer.

REPRODUCTIVE/DEVELOPMENTAL: Trichloroethylene was not embryotoxic or teratogenic in rats or mice inhaling the compound. In a teratology-reproduction study conducted by NTP, rats and mice fed microencapsulated trichloroethylene at doses as high as 300 mg/kg/day (rats) and 750 mg/kg/day (mice) showed little effect.

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION:

Slightly toxic to aquatic life.

Sheepshead Minnows - 96-hour LC50 - 52 mg/l

Mysid Shrimp - 96-hour LC50 - 14 mg/l

Marine Alga - 96-hour EC50 - 95 mg/l

13. DISPOSAL CONSIDERATIONS

DISPOSAL METHOD:

PPG: 44002 Trichloroethylene 10/18/1997

Contaminated sawdust, vermiculite, soil or porous surface must be disposed of in a permitted hazardous waste management facility. Recovered liquids may be reprocessed or incinerated or must be treated in a permitted hazardous waste management facility. Care must be taken when using or disposing of chemical materials and/or their containers to prevent environmental contamination. It is your duty to dispose of the chemical materials and/or their containers in accordance with the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act, as well as any other relevant Federal, State, or local laws/regulations regarding disposal.

RCRA:

Waste trichloroethylene and contaminated soils/materials from spill cleanup are U228 hazardous waste as per 40 CFR 261.33 and must be disposed of accordingly under RCRA.

14. TRANSPORT INFORMATION

USA DOT DESCRIPTION:

Proper Shipping Name: Trichloroethylene
Hazard Class: 6.1 (Harmful - Stow away from foodstuffs)
Identification Number: UN1710
Packing Group: III
Reportable Quantity: 100 lbs./45.4 kg.
Marine Pollutant: No

CANADA TDG DESCRIPTION: Trichloroethylene 6.1 (9.2) UN1710 PG III Marine Pollutant

MEXICO DESCRIPTION: Trichloroethylene 6.1 UN1710 PG III

IMO DESCRIPTION: Trichloroethylene Class 6.1 UN1710 PG III

AO/IATA DESCRIPTION: Trichloroethylene 6.1 UN1710 PG III

15. REGULATORY INFORMATION

USA TSCA: This product is listed on the TSCA Inventory.

EUROPE EINECS: This product is listed on EINECS. (201-167-4)

CANADA DSL: This product is listed on the Canadian DSL.

AUSTRALIA AICS: This product is listed on AICS.

KOREA ECL: This product is listed on ECL. (2-648)

JAPAN MITI (ENCS): This product is listed on MITI.

SARA TITLE III:

SARA (311, 312) Hazard Class: Acute Health Hazard. Chronic Health Hazard.

SARA (313) Chemicals: Listed.

PPG: 44002 Trichloroethylene 10/16/1997

SARA Section 302: Not listed as an Extremely Hazardous Substance.

CERCLA HAZARDOUS SUBSTANCE: Listed in Table 302.4 of 40 CFR Part 302 as a hazardous substance with a reportable quantity of 100 pounds. Releases to air, land or water which exceed the RQ must be reported to the National Response Center, 800-424-8802.

CALIFORNIA PROPOSITION 65: This product is a chemical known to the State of California to cause cancer.

NEW JERSEY RIGHT-TO-KNOW LIST: Also contains butylene oxide (CAS No. 106-88-7).

CANADA REGULATIONS (WHMIS): Class D1B - Toxic Materials. Sensitization to product: None known. Odor threshold: Approx. 80 ppm. Product use: degreasing solvent.

16. OTHER INFORMATION

The following has been revised since the last issue of this MSDS:

Date. Edition. MSDS has been reformatted into 16 sections. Section 8 has been updated. Section 11 has been updated.

Previous revision date: 12/18/1995

Previous edition number: 014

NA = Not Available

LOCKFORMER'S VAPOR DEGREASER TRAINING

EXHIBIT D

Section I: General Information

1) Solvent Cleaning Procedures Test

-Operators must complete and pass applicable sections of a solvent cleaning procedures test.

2) Degreaser Uses

-The degreaser is to be used for removal of oils, greases, waxes, rouges, resins, ect. From metal parts prior to painting, rustproofing, heat treatment or assembly.

3) Physical Parts

- a) Cleaning Tank**
- b) Condenser Assembly**
- c) Water Separator**
- d) Storage Tank**
- e) Flusher Assembly**
- f) Freeboard Chiller**
- g) Cover**

4) Solvent Cycle

- a) Solvent is heated in the boiling chamber by a set of electric immersion heaters.**
- b) Vapor generated rises inside the tank to the level of the peripheral condensing coils.**
- c) Vapor condenses on the cooler coil surface and the distillation drops into the condensate trough immediately below.**
- d) The distilled solvent is piped to a gravity type water separator to remove any moisture.**
- e) The water-free solvent is piped back to the spray reserve tank which overflows to the degreaser boiling sump, thus completing the solvent cycle.**

5) Safety Controls

- a) Safety Vapor Control (manual reset)**
- b) Safety Sump Thermostat (manual reset)**
- c) Vapor-up Thermostat (automatic reset)**
- d) Water Flow Switch (automatic reset)**
- e) High Discharge Water Temperature Thermostat (automatic reset)**
- f) Liquid Level Control (automatic reset)**

Section II: Operation

1) Parts Handling

- a) Parts should be arranged so that they are free-draining in a basket made of steel mesh.
- b) A single layer of parts cleans best, but multiple layers can be processed if care is taken and no pools of solvent are formed.
- c) If the formation of small pools of liquid are impossible to avoid, suspend this type of work in the freeboard area above the condenser so the liquid solvent may drain back into the machine.
- d) The workload should never be larger than 50% of the open top tank area to avoid piston action which pulls vapor out of the machine.
- e) Heavy or bulky single objects may be cleaned by suspending them directly from a hoist as long as the hoist cables are not made of rope or other porous material which may absorb solvent.
- f) Speed of work entering and leaving the vapor zone should not exceed 11 feet per minute (FPM) for parts occupying less than 50% of the open top tank area, slower if possible, or 3 FPM if parts occupy more than 50% of the solvent/air interface area. Parts should not be wet when removed from degreaser.

2) Processing Work

- a) Never overload the machine.
- b) Keep spray wand nozzle under the vapor level.
- c) Keep cover closed when not in use.

3) Daily Startup Sequence

- a) Check solvent level, add as necessary.**
- b) Turn on freeboard chiller.**
- c) Open cooling water supply valve or turn on water chiller. If a cooling tower or water chiller is used, this water can run continuously.**
- d) Turn on heat.**

4) Daily Shutdown Procedure

- a) Close cover.**
- b) Turn heat off.**
- c) Allow water to run for 15-30 minutes before turning off.**
***A small amount of water should be allowed to flow through pipes to avoid freezing.**
- d) Do not turn off refrigeration water chiller when freeboard chiller is operating.**
- e) Do not turn off freeboard chiller. It is an automatic pollution control system.**
- f) If the chiller is to be turned off turn the pump down switch "Start Run-Stop" to the Stop position. This will lower the pressure in the system.**

5) Daily Maintenance

- a) Check around degreaser for signs of developing leaks.**
- b) Remove parts which may have fallen into the degreaser.**
- c) Maintain correct solvent levels by makeup with fresh solvent.**
- d) Check separator water discharge from water separator. A continuous discharge may indicate a leak in the condensing coil or the water separator cooling coil.**
- e) Check the separated water discharge for solvent. Solvent may be backing up due to an obstruction in the solvent discharge line.**

6) Discussion

- a) Safety Issues**
- b) Trichloroethylene MSDS**

APPENDIX B

TEST OF SOLVENT CLEANING PROCEDURES

GENERAL QUESTIONS

- _____ 1. What is the maximum allowable speed for parts entry and removal?
 - A. 8.5 meters per minute (28 feet per minute).
 - B. 3.4 meters per minute (11 feet per minute).
 - C. 11 meters per minute (36 feet per minute).
 - D. No limit.

- _____ 2. How do you ensure that parts enter and exit the solvent cleaning machine at the speed required in the regulation?
 - A. Program on computerized hoist monitors speed.
 - B. Can judge the speed by looking at it.
 - C. Measure the time it takes the parts to travel a measured distance.

- _____ 3. Identify the sources of air disturbances.
 - A. Fans
 - B. Open doors
 - C. Open windows
 - D. Ventilation vents
 - E. All of the above

- _____ 4. What are the three operating modes?
 - A. Idling, working and downtime
 - B. Precleaning, cleaning and drying
 - C. Startup, shutdown, off
 - D. None of the above

- _____ 5. When can parts or parts baskets be removed from the solvent cleaning machine?
 - A. When they are clean
 - B. At any time
 - C. When dripping stops
 - D. Either A or C is correct

- _____ 6. How must parts be oriented during cleaning?
 - A. It does not matter as long as they fit in the parts basket.
 - B. So that the solvent pools in the cavities where the dirt is concentrated.
 - C. So that solvent drains from them freely.

- _____ 7. During startup, what must be turned on first, the primary condenser or the sump heater?
 - A. Primary condenser
 - B. Sump heater
 - C. Turn both on at same time
 - D. Either A or B is correct

- _____ 8. During shutdown, what must be turned off first, the primary condenser or the sump heater?
 - A. Primary condenser
 - B. Sump heater
 - C. Turn both off at same time
 - D. either A or B is correct

- _____ 9. In what manner must solvent be added to removed from the solvent cleaning machine?
 - A. With leak proof couplings
 - B. With the end of the pipe in the solvent sump below the liquid solvent surface.
 - C. So long as the solvent does not spill, the method does not matter.
 - D. A and B

- _____ 10. What must be done with waste solvent and still and sump bottoms?
 - A. Pour down the drain
 - B. Store the closed container
 - C. Store in a bucket
 - D. A or B

_____ 11. What types of materials are prohibited from being cleaned in solvent cleaning machines using halogenated HAP solvents?

- A. Sponges
- B. Fabrics
- C. Paper
- D. All of the above

CONTROL SERVICE SPECIFIC QUESTIONS

[] Freeboard Refrigeration Device

_____ 1. What temperature must the FRD achieve?

- A. Below room temperature
- B. 50°F
- C. Below the solvent boiling point
- D. 30 percent below the solvent boiling point

[] Working-Mode Cover

_____ 2. When can a cover be open?

- A. While parts are in the cleaning machine
- B. During parts entry and removal
- C. During maintenance
- D. During measurements for compliance purposes
- E. A and C
- F. B, C, and D

_____ 3. Covers must be maintained in what condition?

- A. Free of holes
- B. Free of cracks
- C. So that they completely seal cleaner opening
- D. All of the above

[] Dwell

_____ 4. Where must the parts be held for the appropriate dwell time?

- A. In the vapor zone
- B. In the freeboard area above the vapor zone
- C. Above the cleaning machine
- D. In the immersion sump

ANSWERS

General Questions

1. B
2. A or C
3. C
4. A
5. C
6. C
7. A
8. B
9. D
10. B
11. D

Control Device Specific Questions

1. D
2. F
3. D
4. B



QUALITY
ANALYTICAL
LABS, INC.

Job #: 13039 AMENDED
Date: 04/29/92

STS Consultants Ltd.
1869 Techny Road
Northbrook, IL 60062

ATTN: Steve Newlin

Sampling Date: 04/22/92
Analyses Date: 04/22-27/92

Identification: One sample taken by Robert Bryce identified
as:

WATER WELL SAMPLE FROM LOCKFORMER
JOB #26249-YH

Results follow:

EXHIBIT E

"Precision, Accuracy and Service"

1938 C UNIVERSITY LANE • Lisle, IL 60532 • 708 / 512-0061 FAX 708 / 512-0089
TOLL FREE 800 / LAB-0149

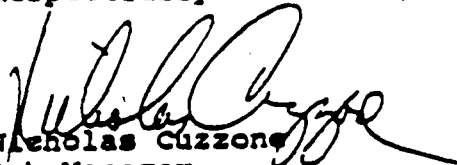
Sample ID: S-1

VOLATILES Method: SW-846 8240 (Modified to capillary)

Parameter	MDL mg/L	Analysis mg/L
1,1-Dichloroethane	0.001	BDL
1,1-Dichloroethene	0.001	BDL
1,1,1-Trichloroethane	0.001	BDL
1,1,2-Trichloroethane	0.001	BDL
1,1,2,2-Tetrachloroethane	0.001	BDL
1,2-Dichloroethane	0.001	BDL
1,2-Dichloropropane	0.001	BDL
1,2,3-Trichloropropane	0.001	BDL
1,4-Dichloro-2-butene	0.001	BDL
2-Butanone (MEK)	0.050	BDL
2-Chloroethyl vinyl ether	0.001	BDL
2-Hexanone	0.010	BDL
4-Methyl-2-pentanone (MIBK)	0.005	BDL
Acetone	0.075	BDL
Acrolein	0.001	BDL
Acrylonitrile	0.001	BDL
Benzene	0.001	BDL
Bromodichloromethane	0.001	BDL
Bromomethane	0.005	BDL
Carbon disulfide	0.001	BDL
Chlorobenzene	0.001	BDL
Chloroethane	0.005	BDL
Chloromethane	0.005	BDL
cis-1,3-Dichloropropene	0.001	BDL
Dibromochloromethane	0.001	BDL
Dibromomethane	0.001	BDL
Dichlorodifluoromethane	0.001	BDL
Ethylbenzene	0.001	BDL
Iodomethane	0.001	BDL
Methylbenzene (Toluene)	0.001	BDL
Methylene chloride	0.001	BDL
Styrene	0.001	BDL
Tetrachloroethane	0.001	BDL
Tetrachloromethane	0.001	BDL
trans-1,2-Dichloroethene	0.001	BDL
trans-1,3-Dichloropropene	0.001	BDL
Tribromomethane (Bromoform)	0.001	BDL
Trichloroethene	0.001	BDL
Trichlorofluoromethane	0.001	BDL
Trichloromethane (Chloroform)	0.001	BDL
Vinyl acetate	0.025	BDL
Vinyl chloride	0.005	BDL
Xylenes (Total)	0.003	BDL

MDL = Method Detection Limit
BDL = Below Detection Limit

Respectfully submitted,


Nicholas Cuzzone
Lab Manager
Quality Analytical Labs, Inc.



Illinois
Environmental
Protection Agency

Bureau of Land
1021 North Grand Avenue East
Springfield, IL 62794-9276

April 2000

EXHIBIT F

IL EPA/BLM/0004009

Accomplishments in 1999

236 Enrollments

147 NFR Letters

926 Acres Remediated

[www.epa.state.il.us/land/
site-remediation](http://www.epa.state.il.us/land/site-remediation)

Welcome

Voluntary cleanups are occurring at a record pace in the Illinois Site Remediation Program. In 1999, the SRP enrolled more sites (236) and issued more No Further Remediation Letters (147) than in any previous year. Not surprisingly, the number of acres remediated in 1999, 926 acres, also increased, up 24 percent from 1998. Interest in the SRP web page has grown as well.

Visitors to the Illinois EPA web site can download SRP application forms and explore the SRP database of over 1,200 voluntary sites.

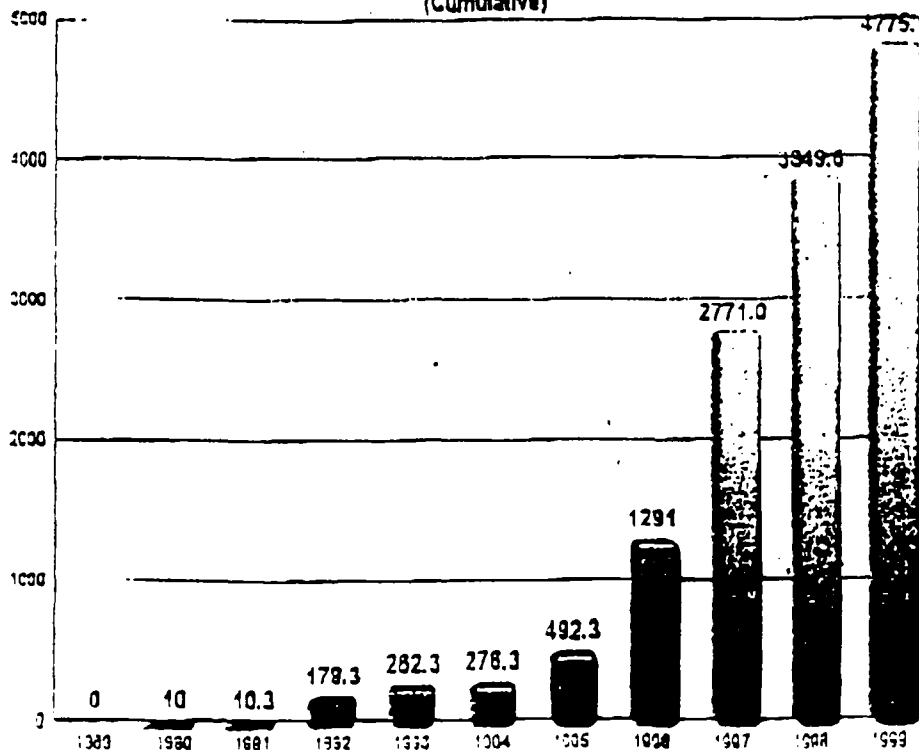
Thomas V. Skinner

Thomas V. Skinner
Director, Illinois EPA

Site Remediation Program

1999 Annual Report

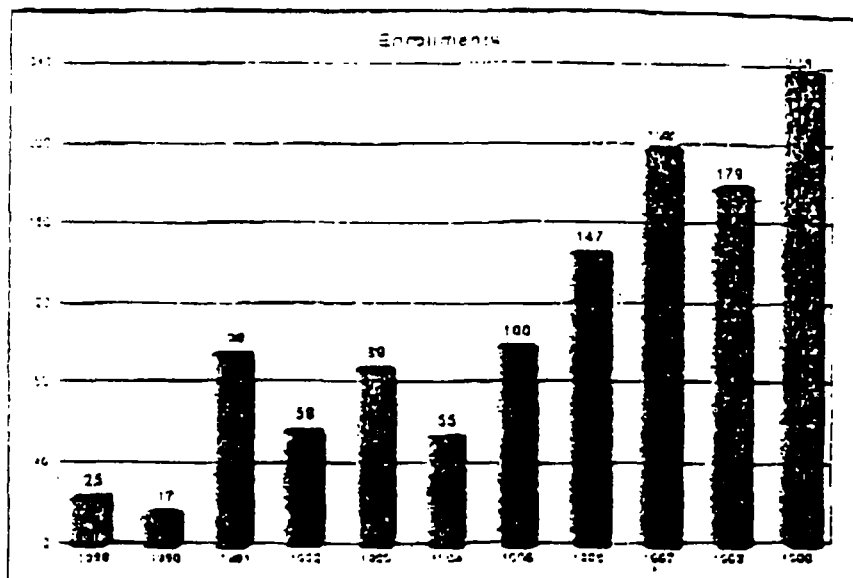
Acres Remediated
(Cumulative)



Enrollments into the Site Remediation Program

In 1999, the SRP experienced a record year for enrollments, with 236 new sites, a 32% increase over the previous year. Increased enrollments may be due to:

- Greater awareness of the SRP
- Endorsements from RAs and consultants participating in the SRP
- Brownfield redevelopment incentives (see page 11) and other sector-specific cleanup incentives (e.g., Dry Cleaner Environmental Response Trust Fund)
- More banks or developers requiring NFR Letters for real estate transactions

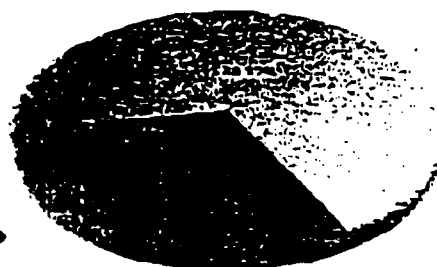


Types of Sites

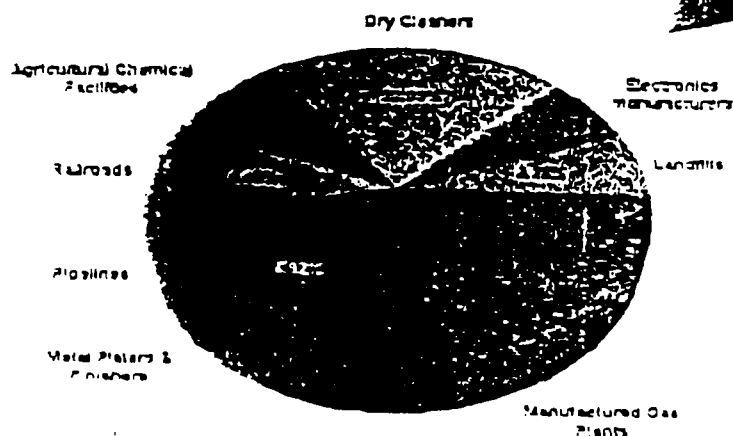
A wide variety of industries have operated throughout Illinois history. Some, such as the manufactured gas plant industry, ceased operation many years ago and no longer exist. However their environmental legacy lives on. Other types of industry, such as drycleaners, have operated for years, but we are now addressing the contamination they have caused.

Major Industry Enrollment in SRP

Unidentified & Miscellaneous Industries



SRP Enrollment Distribution of Major Industries



Over 80% of the 1,200 sites enrolled in the SRP are represented in eight major industry categories: Manufactured gas plants (112 sites), dry cleaners (81 sites), railroads (38 sites), agricultural chemical facilities (32 sites), metal platers & finishers (29 sites), pipelines (26 sites), electronics manufacturers (25 sites), and landfills (25 sites).

The remaining 20% of the 1,200 sites are unidentified at the time of enrollment or represent miscellaneous industries (e.g., petroleum releases, lumber yards, firing ranges, landfills, etc.).

Eliminating Unacceptable Risk to Human Health and the Environment

TACO regulations describe how site-specific remediation objectives can be developed. These remediation objectives are based on risk caused by either exposure to hazardous substances, or the toxicity of those substances, or some combination of the two. In some cases, sites will be remediated by removing all of the contaminants. However, under TACO, sites can be cleaned to protective and acceptable risk levels without removing all of the contaminants by using institutional controls and engineered barriers.

Institutional Controls are legal mechanisms for imposing restrictions and conditions on land use. These controls may include specific NFR conditions, environmental land use controls, ordinances adopted by a unit of local government, or agreements between a property owner and a highway authority. The conditions or restrictions found in institutional controls all serve to prevent human exposure to remaining contaminants based on site-specific conditions (e.g., amount of contamination left behind, geology of the site, location of site, population at risk, etc.).

Engineered barriers limit exposure and/or controls migration of contaminants. A barrier may be natural or human-made, but its effectiveness must be verified by accepted engineering practices. If an engineered barrier is used, it must be accompanied by an institutional control which assures the proper maintenance of the barrier.

The NFR Letter will identify any such controls and barriers. Since the NFR Letter is filed with the property's deed, these controls limit future activities to insure those activities don't increase risk.

Close to half of the NFR Letters issued have institutional controls in place. Approximately 26% of these institutional controls rely on a groundwater ordinance that limits the community's drinking water source to a public water supply.

Groundwater Ordinances

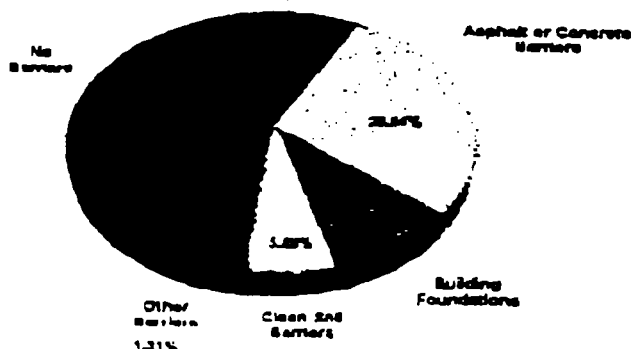
The following communities have groundwater ordinances that have been approved by the Illinois EPA for use as an institutional control.

- | | |
|---------------------|------------------|
| > Alton | > Mendon |
| > Bedford Park | > Moline |
| > Bellwood | > Oak Lawn |
| > Bensenville | > Oak Park* |
| > Chicago | > Peoria* |
| > Cicero | > Quincy |
| > East Moline | > River Forest |
| > East St. Louis | > River Grove |
| > Elk Grove Village | > Rockford |
| > Elmwood Park | > Rock Island* |
| > Evanston | > Rosemont |
| > Franklin Park | > Summit |
| > Havana | > Willow Springs |
| > Markham | |
| > McCook | |

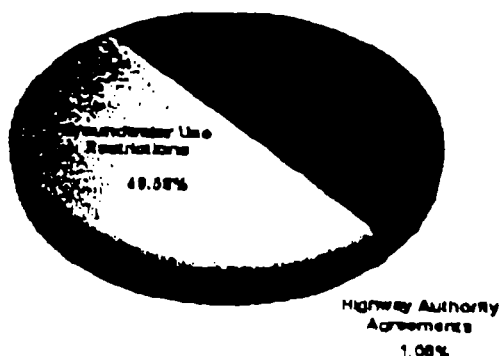
*Limited area

As of December 1999

Use of Engineered Barriers
in No Further Remediation Letters



Use of Institutional Controls
in No Further Remediation Letters



No Further Remediation Letters

The annual rate of NFR Letters issued continued to grow in 1999, with 147 Letters issued (an 8% increase over last year).

The type of NFR Letter issued by the Illinois EPA depends on the scope of the investigation and subsequent actions.

A "comprehensive" NFR Letter affirms that the site does not constitute a significant risk of harm to human health and the environment, so long as the site is used in accordance with the terms and conditions of the NFR Letter.

To qualify for a "comprehensive" NFR Letter, the RA will be required to:

- Identify all recognized environmental conditions that may exist at a site. Usually, sampling analyses including volatiles, semi-volatiles, and metals must be conducted. Occasionally, and as determined on a case-by-case basis, sampling may be required for agricultural chemicals, PCDs and dioxin.
- Implement a remedial action that demonstrates that all environmental conditions at the site do not present a significant risk to human health and the environment.

A "focused" NFR Letter is for those RAs who want to limit their remedial actions to specific chemical or set of chemicals (e.g., BTEX) at a site.

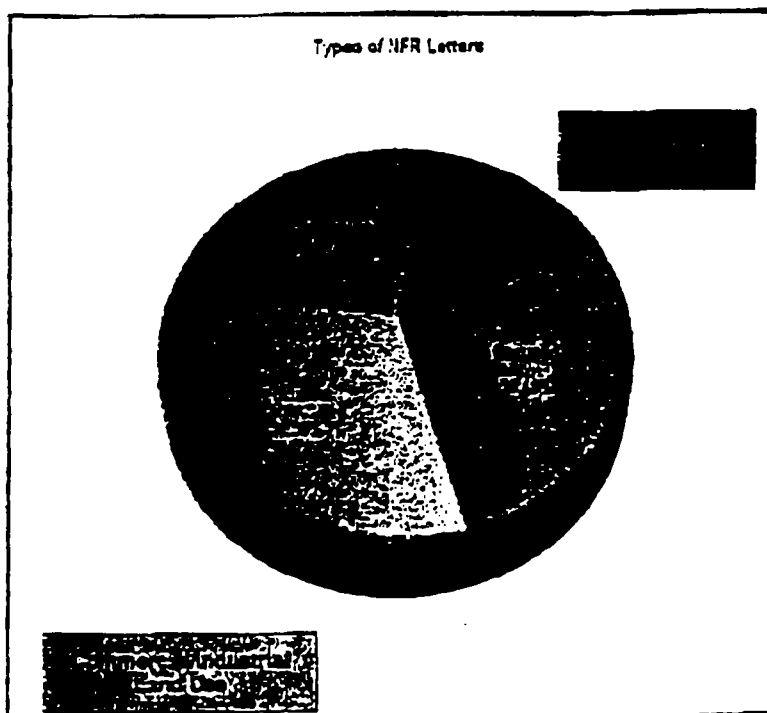
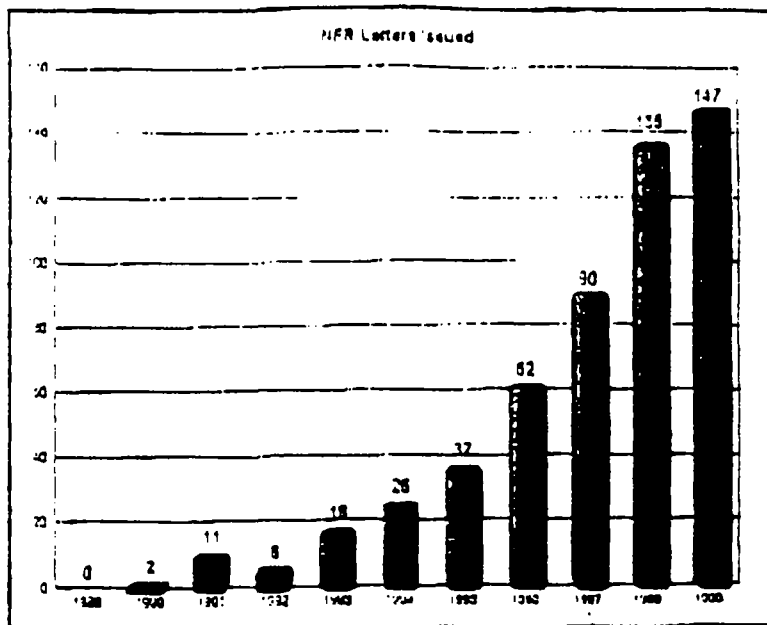
The focused NFR Letter may appeal to those RAs trying to satisfy either a contractual relationship or a specific release of hazardous substances.

Under TACO, the RA can adjust the remediation objectives based on the future use of the land (industrial/commercial or residential) which in turn influences the level of cleanup required.

Residential property is any real property that is used for habitation by individuals or properties where children have the opportunity for exposure to contaminants through ingestion or inhalation at educational facilities, health care facilities, child care facilities or playgrounds.

Industrial/Commercial property is any real property that does not meet the definition of residential property, conservation property or agricultural property.

Through December 1999, the remediation objectives for over 56% of the NFR Letters issued were based on an industrial/commercial land use.



The land use categories in TACO does not necessarily correlate to local planning and zoning codes (i.e., a site may be cleaned up to residential land use standards under TACO, but the property may be zoned for commercial use by the local government).